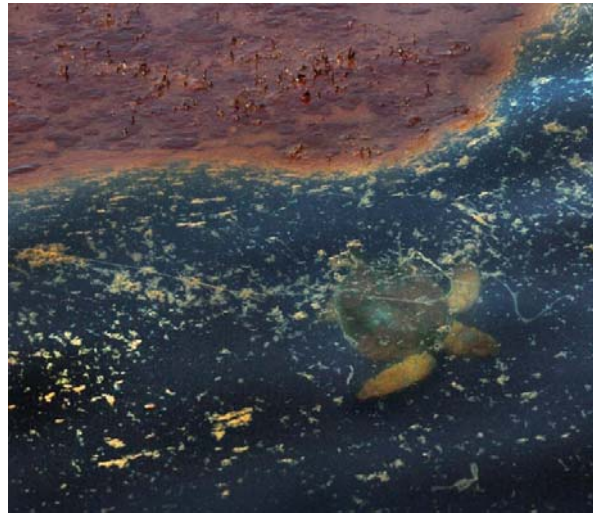


U.S. Department of Interior
Interim, Partial Claim for Assessment Costs
20 April 2010 Deepwater Horizon (MC252) Spill



1 July 2011



Table of Contents

1.0 Executive Summary	1
2.0 Administrative Information	5
2.1 Claimant Eligibility and Coordination with Co-Trustees	5
2.2 Responsible Party Information	6
2.3 Determination of Jurisdiction	6
2.4 Time Limitations on Claims	6
2.5 Legal Action.....	6
2.6 Claim Presentation.....	6
3.0 Assessment: Overview of Approach.....	7
3.1 Endangered/Threatened Turtles (3 assessment procedures)	8
3.2 Birds (13 assessment procedures).....	9
3.3 Endangered/Threatened Fish (1 assessment procedure).....	11
3.4 Endangered/Threatened Mammals (1 assessment procedure).....	12
3.5 Other (7 assessment procedures)	12
4.0 Endangered/Threatened Turtles	14
4.1 Nesting and Hatchling Kemp’s Ridley Sea Turtles	14
4.2 Nesting and Hatchling Loggerhead Sea Turtles	15
4.3 Turtle Analytical Plan	18
5.0 Birds	20
5.1 Beach Habitat Carcass Persistence Study	20
5.2 Marsh Edge Searcher Efficiency Study	22
5.3 Marsh Edge Carcass Persistence Study	24
5.4 Carcass Drift Study	26
5.5 Colonial Waterbird Photo Census and Analysis of Oiling and Survival Data	29
5.6 Pelagic Oiled Bird Photo Evaluation	31
5.7 Secretive Marsh Bird Helicopter Calibration	32
5.8 Supplement to Gulf Coast Breeding, Beach-Nesting Bird Population Surveys	35
5.9 UV Screening to Detect Petroleum on Bird Plumage with Ultraviolet Light.....	37
5.10 Wildlife Operations and Law Enforcement Data Assessment for Beached Bird Model Use	38
5.11 Avian Injury Quantification Technical Support	40
5.12 Blood Physiology Study	41
5.13 Avian Toxicity Studies	43
6.0 Endangered/Threatened Fish	46
6.1 Gulf Sturgeon.....	46
7.0 Endangered/Threatened Mammals	48
7.1 Beach Mice Assessment	48
8.0 Other Assessment Procedures.....	50
8.1 Aerial Imagery	50
8.2 Response Injury and Sandy Beach Technical Assistance.....	51
8.3 Near Shore Benthic Prey Organisms	53
8.4 JELA SAV Plan	53
8.5 Quality Assurance and Quality Control Program	54
8.6 Expert Consultation and Technical Support	55
8.7 Early Restoration Planning	55

9.0 DOI Coordination, Oversight, Implementation and Analysis Costs.....	56
10.0 Literature Cited	57

List of Exhibits and Figures

Exhibit 1	Injury Assessment Procedures Summary Budgets	3
Exhibit 2	Costs for DOI Oversight, Coordination, Implementation, and Analysis	4
Exhibit 3	Contingency Funds and Total	4
Figure 1	Proposed secretive marsh bird helicopter calibration survey transect areas	33

1.0 EXECUTIVE SUMMARY

On April 20, 2010, an explosion and fire on the *Deepwater Horizon* mobile offshore drilling unit resulted in 11 worker fatalities and discharges of oil and other substances from the rig and seabed wellhead into the Gulf of Mexico. Pursuant to section 1006 of the Oil Pollution Act ("OPA"), 33 U.S.C. §§ 2701, *et seq.*, federal, state, and federally recognized tribes are trustees for natural resources and are authorized to act on behalf of the public to: (1) assess natural resource injuries resulting from a discharge of oil or the substantial threat of a discharge and response activities and; (2) develop and implement a plan for restoration of such injured resources.

Immediately following the *Deepwater Horizon*/Mississippi Canyon 252 ("MC252") Oil Spill (referred to herein as "Deepwater Horizon Oil Spill", "Oil Spill" and/or "Incident" which may include, as applicable, all incident(s) related to the events of the explosion, fire and subsequent discharges of oil and other substances from the rig and wellhead on the seabed into the Gulf of Mexico), the affected Trustees initiated joint efforts to begin the collection and analysis of: (1) data reasonably expected to be necessary to make a determination of jurisdiction or a determination to conduct restoration planning; (2) ephemeral data; and (3) information needed to design or implement anticipated emergency restoration and assessment activities as part of the Restoration Planning Phase. In addition, pursuant to Natural Resource Damage Assessment (NRDA) regulations (15 CFR § 990.14), one of the identified responsible parties, BP Exploration and Production, Inc., informed the Trustees of its intent to participate in the Deepwater Horizon NRDA. As a result, the Trustees have provided BP opportunities to comment on Trustee-developed assessment plans and to participate in field work implementing studies upon which the Trustees and BP have reached a mutual agreement. As a condition of participation, BP has been required to fund the agreed upon plans.

Pursuant to the NRDA regulations applicable to OPA, 15 C.F.R. Part 990 ("NRDA regulations"), the Trustees issued a Notice of Intent to Conduct Restoration Planning ("Notice"). That Notice confirmed the Trustees' intention to proceed with restoration planning to fully evaluate, assess, quantify and develop plans for restoring, replacing or acquiring the equivalent of natural resources and their services injured by and losses resulting from the *Deepwater Horizon* Incident. The restoration planning process will include collection of information that the Trustees determine is appropriate for identifying and quantifying natural resource injuries and associated losses of resources and their services, and determination of the need for, and type and scale of restoration actions.

This document identifies 25 Assessment procedures, including studies, which agencies within the U.S. Department of the Interior plan to implement in 2011 and 2012 to inform natural resource damage injury determination and quantification analyses associated with the *Deepwater Horizon* Oil Spill ("Claim document" or "Claim"). The collection of studies identified: (1) reflect consideration of the factors identified in 15 C.F.R. §990.27 (use of assessment procedures), §990.51 (injury determination) and §990.52 (injury quantification); (2) are limited to injury assessment only (i.e., restoration-related activities are not included, other than technical support for participation in the early restoration process recently agreed to by the Trustees and BP); (3) reflect consideration of data and analyses conducted during the pre-assessment phase; and (4) have been developed in coordination with U.S. Department of the Interior's (DOI) co-Trustees. These DOI assessment activities are a subset of the ongoing NRDA activities being

conducted by all Trustees. DOI assessment activities in this Claim document focus on impacted natural resources that DOI directly manages – including migratory birds, endangered species, and DOI-managed lands and facilities. Furthermore, as more information about the impacts of the Oil Spill becomes available, DOI expressly reserves its ability to supplement the assessment procedures identified herein.

Exhibit 1 provides summary cost information for each of the 25 activities included in this Claim document. As shown in Exhibit 1, estimated costs for assessment procedures, including field studies, laboratory and data analyses total approximately \$21.9 million. Exhibit 2 provides estimated costs for coordination, oversight, implementation and analysis activities for DOI personnel in 2011 and 2012. As shown, these costs total \$36.8 million. Finally, as shown in Exhibit 3, DOI also seeks \$8.8 million in contingency funds, estimated at 15% of the sum of study and oversight/coordination costs. Contingency funds are intended to cover the risk that costs turn out to be higher than expected, and only will be made available upon documentation of higher than expected costs.

In total, DOI is seeking a sum certain of \$67.5 million for injury assessment activities specified in this document. Data collection and analysis is ongoing, and may result in the identification of additional injury assessment activities by DOI and/or its co-Trustees. The need for any such studies and assessment activities and their relationship to existing data collection efforts and analyses will be clearly identified in any future assessment claims.

Exhibit 1 – Injury Assessment Procedures Summary Budget

Endangered/Threatened Turtles	
Nesting and Hatchling Kemp's Ridley Sea Turtles	\$386,704
2011 Assessment Costs	41,979
2012 Field Work Plan Costs	344,725
Nesting and Hatchling Loggerhead Sea Turtles	248,090
2011 Assessment Costs	70,000
2012 Field Work Plan Costs	178,090
Turtle Analytical Plan	2,698,024
2010 Assessment Costs	1,203,243
2011 Assessment Costs	1,494,781
Birds	
Beach Habitat Carcass Persistence	\$244,000
Marsh Edge Searcher Efficiency	198,000
Marsh Edge Carcass Persistence	200,000
Carcass Drift	1,076,000
Colonial Waterbird Photographic Census	853,000
Colony Counts in Breeding Season	119,000
Pelagic Oiled Bird Photo Evaluation	72,000
Secretive Marsh Bird Helicopter Calibration	156,000
Suppl. to Gulf Coast Breeding, Beach-Nesting Population Surveys	260,000
UV Screening to Detect Petroleum on Bird Plumage	63,000
Wildlife Ops Data Assessment for Beached Bird Model Use	164,000
Avian Injury Quantification Technical Support	775,000
Blood Physiology	125,000
Avian Toxicity (Plan Development and Implementation)	4,785,000
Endangered/Threatened Fish	
Gulf Sturgeon	\$1,074,768
Endangered/Threatened Mammals	
Beach Mice	\$66,360
Other	
Aerial Imagery	\$5,040,000
2011 Assessment Costs	2,506,000
2012 Assessment Costs	2,534,000
Response Injury and Sandy Beach	158,366
Near Shore Benthic Prey Organisms	961,000
JELA SAV Plan	142,506
Quality Assurance and Quality Control (QA/QC)	153,500
Expert Consultation	1,504,948
Early Restoration Planning	450,000
Grand Total	\$21,855,265

Notes:

(1) Additional budget detail is available upon request.

(2) \$13.5 million in addition to these costs are necessary to fund labor effort of government personnel designated as Principal Investigators for specific studies. These DOI personnel costs are for study implementation, and are separate from and in addition to DOI oversight, coordination and related costs. Both types of DOI Personnel costs are summed in Exhibit 2.

(3) Studies are generally planned for implementation and completion in 2011/2012.

Exhibit 2 – Costs for DOI Oversight, Coordination, Implementation and Analysis

Name of Agency	TOTAL DOI Coordination, Oversight, Implementation, and Analysis
U.S. Fish & Wildlife Service	\$15,911,452
National Park Service	2,073,786
U.S. Geological Survey	14,917,008
Bureau of Indian Affairs	400,000
Bureau of Land Management	400,000
DOI Solicitors	3,147,509
Total	\$36,849,756

Exhibit 3 – Contingency Funds and Total

	AC Cost	15% of AC Cost (Contingency)	Total AC
DOI Personnel Costs	\$36,849,756	\$5,527,463	\$42,377,219
Assessment Procedure Costs	21,855,265	3,278,290	25,133,555
Total	\$58,705,021	\$8,805,753	\$67,510,774

2.0 ADMINISTRATIVE INFORMATION

2.1 Claimant Eligibility and Coordination with Co-Trustees

The following governmental entities are designated natural resource trustees under OPA and are currently acting as Trustees for this Incident:

- the U.S. DOI, as represented by the National Park Service (“NPS”), United States Fish and Wildlife Service (“USFWS”), Bureau of Indian Affairs (“BIA”), and Bureau of Land Management (“BLM”);
- the National Oceanic and Atmospheric Administration ("NOAA"), on behalf of the United States Department of Commerce;
- the United States Department of Defense ("DOD");
- the State of Louisiana's Coastal Protection and Restoration Authority, Oil Spill Coordinator's Office, Department of Environmental Quality, Department of Wildlife and Fisheries and Department of Natural Resources;
- the State of Mississippi's Department of Environmental Quality;
- the State of Alabama's Department of Conservation and Natural Resources and Geological Survey of Alabama;
- the State of Florida's Department of Environmental Protection; and Florida Fish and Wildlife Conservation Commission
- the State of Texas' Parks and Wildlife Department, General Land Office, and Commission on Environmental Quality, (collectively, the "Trustees").

In addition to acting as Trustees for this Incident under OPA, the States of Louisiana, Mississippi, Alabama, Florida and Texas are also acting pursuant to their applicable state laws and authorities, including the Louisiana Oil Spill Prevention and Response Act of 1991, La. R.S. 30:2451 *et seq.*, and accompanying regulations, La. Admin. Code 43: 10 1 *et seq.*; the Texas Oil Spill Prevention and Response Act, Tex. Nat. Res. Code, Chapter 40, Section 376.011 *et seq.*, Fla. Statutes, and Section 403.161, Fla. Statutes; the Mississippi Air and Water Pollution Control Law, Miss. Code Ann. § § 49-17-1 through 49-17-43; and Alabama Code § § 9-2-1 *et seq.* and 9-4-1 *et seq.*

Several technical working groups (“TWGs”), each comprised of Trustee representatives, have been established to guide and coordinate data collection and analysis for NRDA purposes. As appropriate, these TWGs coordinate with and consider input from BP on TWG activities. The procedures identified in this document are planned to be implemented and/or overseen by DOI personnel, and were developed in coordination with DOI’s co-Trustees, including TWG review.

2.2 Responsible Party Information

The Responsible Parties ("RPs") identified for this Incident thus far are BP Exploration and Production, Inc. ("BP"); Transocean Holdings Inc. ("Transocean"); Triton Asset Leasing GmbH ("Triton"); Transocean Offshore Deepwater Drilling Inc. ("Transocean Offshore"); Transocean Deepwater Inc. ("Transocean Deepwater"); Anadarko Petroleum ("Anadarko"); Anadarko E&P Company LP ("Anadarko E&P"); and MOEX Offshore 2007 LLC ("MOEX"). Pursuant to 15 CFR § 990.14(c), concurrent with the publication of the Notice to Conduct Restoration Planning, the Trustees invited the RPs identified above to participate in an NRDA. The Trustees have coordinated with BP, the only RP who accepted this invitation to actively participate in the NRDA process.

2.3 Determination of Jurisdiction

For reasons identified in the Notice of Intent to Conduct Restoration Planning for this Incident, the Trustees have determined they have jurisdiction to pursue restoration under OPA. 75 Fed. Reg. 60800 (Oct. 1, 2010).

2.4 Time Limitations on Claims

This claim for funding of reasonably necessary assessment procedures to inform Incident-specific injury determination and quantification analyses is presented in writing to the Director, National Pollution Funds Center (NPFC) within time limits specified in 33 C.F.R. §136.101 (i.e., within three years from the date of completion of the natural resources damages assessment). The natural resources damage assessment for this Incident is ongoing and has not been completed.

2.5 Legal Action

On December 15, 2010, the United States filed its complaint against the RPs in the Eastern District of Louisiana (Civil Case no. 2:10-cv-04536). At this time, the trial schedule does not include natural resource damages quantification in the first two phases of litigation.

2.6 Claim Presentation

This Interim, Partial Claim for Assessment Costs has been presented for a sum certain, in accordance with OPA to all of the identified RPs by letters dated February 25, 2011.

3.0 ASSESSMENT: OVERVIEW OF APPROACH

OPA regulations provide that NRDA procedures be tailored to the circumstances of the incident and the information needed to determine appropriate restoration. With respect to standards for assessment procedures, the regulations provide that (15 CFR § 990.27(a)):

- (1) The procedure(s) must be capable of providing assessment information of use in determining the type and scale of restoration appropriate for a particular injury;
- (2) The additional cost of a more complex procedure must be reasonably related to the expected increase in the quantity and/or quality of relevant information provided by the more complex procedure; and
- (3) The procedure must be reliable and valid for the particular incident.

OPA regulations identify several categories of assessment procedures available to trustees, including but not limited to: procedures conducted in the field or laboratory; model-based procedures; and /or literature-based procedures (15 CFR § 990.27(b)). If a range of assessment procedures providing the same type and quality of information is available, the most cost-effective procedure must be used (15 CFR § 990.27(c)). Finally, assessment procedures must contribute to injury determination (i.e., by establishing the spatial and temporal magnitude of exposure to oil, the pathway(s) of exposure, and/or the presence of injury, as described in 15 CFR § 990.51) and/or injury quantification (i.e., quantifying the degree, spatial and temporal extent of injury to natural resources and the associated reduction in services caused by the injury, as described in 15 CFR § 990.52).

Through TWG and internal review processes, DOI has determined that the assessment procedures identified in this document meet these requirements, and are integrated with (and not duplicative of) other NRDA data collection and analysis activities. All of the activities make use of field, laboratory, model and/or literature-based methods. Many involve the collection of field data needed to confirm the presence of natural resource injury and/or inform estimates of the magnitude of injury and associated reductions in services. The scale and cost of each activity was carefully considered, and represents a balance between the need for cost-effective assessment efforts and the unprecedented geographic scale and complexity of this Oil Spill, in light of input provided by DOI's co-Trustees.

It is important to keep in mind that the identified DOI assessment procedures are a subset of the ongoing NRDA activities being conducted jointly by all Trustees. For more information about previous and ongoing studies, visit the Deepwater Horizon Oil Spill NRDA Administrative Record at <http://www.doi.gov/deepwaterhorizon/adminrecord/index.cfm>. Furthermore, as more information about the impacts of the Oil Spill becomes available, DOI expressly reserves its right to supplement the assessment procedures identified herein through additional claims for assessment costs. Modifications to the identified assessment procedures may be made because of the participation of BP in the NRDA pursuant to 15 CFR 990.14.

A description of each assessment activity's purpose, methods, relationship to other studies and data, and coordination and implementation information is provided in subsequent sections of this

document. Additional budget detail can be provided upon request. Brief summaries of the role of each procedure in the injury assessment are provided below. The Budget summary for each activity reflects contractor costs only, consistent with the format developed for the case-wide NRDA. DOI personnel and travel costs affiliated with a particular procedure, where DOI employees are themselves implementing the procedure as well as general oversight, coordination and analysis costs, are instead included in the DOI Oversight, Coordination, Implementation and Analysis budget in Section 9.0 and Exhibit 2.

3.1 Endangered/Threatened Turtles (3 assessment procedures)

Nesting and Hatchling Kemp's Ridley Sea Turtles (4.1) - Kemp's ridley turtles nest along the Texas shoreline in the Gulf of Mexico and many remain in the Gulf for their entire lives. This study will assess potential exposure and injury to Kemp's ridley nesting adults, hatchlings, and eggs from Deepwater Horizon oil and dispersants. The assessment includes nesting female physical evaluations, satellite tracking of nesting female inter-nesting and post-nesting movements, blood samples and tissue biopsies collections from nesting females, collection of residual tissue samples from eggshells, non-viable eggs, and hatchlings, assessment of hatching and emergence success, and collection of nest sand samples. Samples collected during the study will be tested for potential egg and hatchling toxicity impacts and hatchling emergence success as a function of pre-discharge conditions and post-discharge concentrations of Deepwater Horizon oil (referred to herein as "DWH oil" or "MC252 oil"), and on nesting females, hatchlings, eggs, and nesting substrate to determine if a relationship between exposure and injury exists (See Turtle Analytical Plan). As appropriate, samples will be analyzed for oil, including polycyclic aromatic hydrocarbons (PAHs), and physiological, genetic and/or toxicological parameters. Comparison of 2011 and 2012 data obtained from this study with similar data from the same area collected prior to possible contaminant exposure resulting from the Deepwater Horizon Oil Spill will inform injury determination and quantification evaluations.

Nesting and Hatchling Loggerhead Sea Turtles (4.2) - Loggerhead turtles nest along the Gulf Coast and often remain in the Gulf between nesting seasons and during the inter-nesting interval. This study will assess potential exposure and injury to loggerhead nesting adults, hatchlings, and eggs from Deepwater Horizon oil, dispersants, and response activities. The assessment includes nesting female physical evaluations, satellite tracking of nesting female inter-nesting and post-nesting movements, blood samples and tissue biopsies collections from nesting females, collection of residual tissue samples from eggshells, non-viable eggs, and hatchlings, assessment of hatching and emergence success, and collection of nest sand samples. Samples collected during the study will be tested for potential egg and hatchling toxicity impacts and hatchling emergence success as a function of pre-discharge conditions and post-discharge concentrations of MC252 oil, and on nesting females, hatchlings, eggs, and nesting substrate to determine if a relationship between exposure and injury exists (See Turtle Analytical Plan, below). As appropriate, samples will be analyzed for oil, including PAHs, physiological and/or toxicological parameters. Comparison of 2011 and 2012 data obtained from this study with historical data from the same area will inform injury determination and quantification evaluations.

Turtle Analytical Plan (4.3) - This study will contribute to the assessment of oil exposure and injuries to sea turtles through analysis of a variety of matrices collected as part of the Kemp's ridley and loggerhead nesting studies described above. As observed, embryo and hatchling

deformities will be photographed. Analyses for petroleum profiles and PAHs will provide exposure data while biochemical, physiological, anatomical and genetic data will allow for evaluation of potential links between exposures and lethal and sub-lethal injury.

3.2 Birds (13 assessment procedures)

Beach Habitat Carcass Persistence Study (5.1) - The objective of this study is to evaluate the daily persistence rates of carcasses on beaches in order to estimate the proportion of carcasses that persisted long enough to be found by Deepwater Horizon beached bird survey crews typically working at 3 to 4 day intervals from late May through September 2010. Carcass persistence studies have been undertaken as part of assessment efforts for several oil spills in the U.S. (e.g., the *Selendang Ayu*, *Cosco Busan*, *Bouchard B-120*, *Kure*, *New Carissa*, *Exxon Valdez*, and *Nestucca* incidents). This study will inform injury quantification evaluations.

Marsh Edge Searcher Efficiency Study (5.2) - This study will evaluate searcher efficiency in marsh habitats, where factors such as vegetative cover/habitat and standing water may influence the ability of search teams to find bird carcasses. The study objective is to estimate carcass detection rates for survey/response crews that searched for carcasses in marsh edge habitat. A pre-assessment searcher efficiency study was conducted for coastal and barrier island beach habitat; a similar effort is needed to address unique conditions affecting visibility in marshes (including type and density of vegetation, search platform, etc). Results from this study will complement data collected pursuant to the Marsh Edge Carcass Persistence Study and facilitate development of estimates of total avian mortality.

Marsh Edge Carcass Persistence Study (5.3) - This study will evaluate carcass persistence in marsh habitats, where factors such as vegetative cover/habitat and standing water may influence scavenging and decomposition, resulting in carcass persistence that differs from that determined along open beach habitats. The study objective is to estimate daily persistence rates of carcasses on marsh edges in order to estimate the proportion of carcasses that persisted long enough to be found by survey/response crews. This study will inform injury quantification evaluations.

Carcass Drift Study (5.4) - This study is designed to estimate the likelihood that birds dying at sea would be beached and thus be accounted for by beached bird surveys. The study will make use of radio telemetered bird carcasses to determine the movement patterns and persistence of floating carcasses before they are beached. Carcasses will be tracked until they are beached or until their radio signals terminate, indicating that the carcass has either sunk or been eaten. The issue of birds that are lost before beaching arises regularly, and has been addressed through similar studies in damage assessments for other oil spills (e.g., the *Nestucca*, *Exxon Valdez*, *Citrus*, and the *S.S. Jacob Luckenbach* incidents). This study will inform injury quantification evaluations.

Colonial Waterbird Photo Census and Analysis of Oiling and Survival Data (5.5) - A pre-assessment photographic census of colonial waterbirds on breeding colonies in 2010 and 2011 collected data on the abundance of seabird and coastal wader colonies in the Gulf of Mexico. In this study, colony photographs from 2011 will be analyzed and compared to 2010 data to perform a Before-After/Control-Impact (BACI) analysis to compare the numbers of nesting birds present in the colonies between 2010 and 2011. In addition, as part of this study these

abundance data will be integrated with other pre-assessment study data that estimate the percentage of visibly-oiled birds and estimation of mortality rates of oiled adult birds. This study will inform injury quantification evaluations.

Pelagic Oiled Bird Photo Evaluation (5.6) - This study is intended to reduce uncertainty in the oiling rate observation data collected during pre-assessment pelagic bird surveys by evaluating birds in photographs taken during the pelagic surveys, a technique that has revealed higher oiling rates than observed by strictly visual, real-time observations of birds in the field. At least 900 photographs were taken of the birds observed as part of pre-assessment studies. Initial evaluation of the photographs revealed evidence that many more birds were oiled than were detected by visual, real-time field observations. This study will involve the systematic review of all the photographs collected in relevant pre-assessment studies, data recording and analysis, and development of input for use in injury quantification analyses.

Secretive Marsh Bird Helicopter Calibration (5.7) - As part of the Pre-Assessment Secretive Marsh Bird Study, helicopter transect surveys were undertaken in Louisiana in August and September 2010 to collect data on densities of secretive marsh birds. Documentation of secretive marsh birds via helicopter surveys relies heavily on visual observations as birds flush from vegetation. This study will employ additional helicopter surveys to gather data needed to assess the probability of observing a bird (i.e., flushing from vegetation) in the field of view of helicopter surveyors and the probability of observing a bird at varying perpendicular distances from the transect mid-line to birds sighted. These data will enable estimation of the proportion of birds missed by surveys, increasing the accuracy of local density estimates. Study results will inform injury quantification evaluations.

Supplement to Gulf Coast Breeding, Beach-Nesting Bird Population Surveys (5.8) – As part of this study, beach-nesting birds will be re-surveyed in 2011 throughout coastal areas that support solitary beach-nesting birds from the Florida/Alabama border to Galveston Island, Texas. Surveys will locate nesting sites and enumerate the breeding populations of beach-nesting birds in order to inform evaluation of shorebird injuries that may have occurred since Coastal Bird Conservation (CBC) conducted pre-spill breeding surveys in 2010. The 2011 surveys will duplicate CBC's 2010 beach-nesting bird census and data collection methodology.

UV Screening to Detect Petroleum on Bird Plumage with Ultraviolet Light (5.9) - Several pre-assessment and assessment studies investigate potential bird exposure to spill-related crude oil through the capture and investigation of live birds. PAH compounds in crude oil fluoresce when illuminated with ultraviolet (UV) light. Deepwater Horizon studies take advantage of this characteristic in an attempt to better estimate potential bird exposure to oil, recording fluorescence of foreign substances on a bird's body under UV illumination. Results include observations of fluorescence on both visibly and not visibly oiled live birds, as well as carcass materials recovered during survival studies. This study will evaluate the accuracy and precision of UV screening methods to better assess the extent of external oiling of captured birds and recovered carcasses. Further study of factors that may affect fluorescence and its use as an indicator of MC252 crude oil contamination may be needed to refine estimates of the number of birds exposed to oil during the Oil Spill.

Wildlife Operations Data Assessment for Beached Bird Model Use (5.10) - Carcass recoveries by beached bird NRDA survey crews represent only a portion of the total recoveries for this Incident. Many carcasses were recovered by Wildlife Operations (Ops), a part of the Response, and by Law Enforcement (LE) personnel. Considerable Ops (and to a lesser extent LE) search effort occurred in marshes and other access-limited areas, and extensive records from these trips are available for NRDA use. These records include daily narrative reports, GPS track lines, and recovery coordinates. This activity will evaluate the extensive Ops/LE data and trip records to associate Ops/LE-collected carcasses with Ops/LE search area and effort and estimate the searcher efficiency of Ops/LE field personnel. This information will assist injury quantification efforts by developing estimates of carcass deposition rates in areas where the NRDA beached bird surveys were not routinely conducted.

Avian Injury Quantification Technical Support (5.11) - Data needed to assess injury to birds from the Incident are being generated by a series of pre-assessment and assessment studies, many cooperative between the Trustees and BP. The following two models will be used, along with other lines of evidence, to assist in the evaluation and quantification of avian injuries: the Beached Bird Model (BBM), based on carcass deposition on beaches and marsh shorelines, carcass detection efficiency, carcass persistence and potentially other factors; and the Live Oiled Bird Model (LOBM), based on the number of birds present in spill-affected areas, the percentage of birds oiled, oiled bird survival rates, and potentially other factors. These models have been utilized to help quantify avian injuries in other oil spills (see, for example, Ford 2006 and Ford 2001). This technical support will apply Incident-specific data in the BBM and LOBM, including review, analysis and incorporation of data from multiple studies.

Blood Physiology Study (5.12) - The objective of this study is to determine whether hemolytic anemia is a key diagnostic feature in birds oiled by the Oil Spill and whether biomarkers of hemolytic anemia and other physiological and biochemical indicators of bird health are consistently related to oiling of birds. Biological samples were collected in three pre-assessment studies (Colonial Waterbird, Secretive Marshbird and Non-breeding Shorebird studies) to evaluate changes in blood constituents in birds exposed to DWH oil. This study will continue ongoing assessment of physiological injury to oiled birds by evaluating blood parameters from samples already collected from birds in areas exposed to DWH oil and from reference locations. Study results will inform injury determination and quantification evaluations.

Avian Toxicity Studies (Section 5.13) - The Trustees will conduct avian toxicity studies to evaluate the effects of DWH oil, dispersants and their related compounds on various representative avian species. Spill-specific toxicity studies are contemplated to assist with interpretation of field and laboratory avian studies conducted in the pre-assessment phase throughout oil-impacted areas in the Northern Gulf region, particularly with respect to evaluation of the impacts of oil exposure that does not result in immediate or short-term mortality but may cause physiological impacts that may ultimately impact avian survival, reproduction and health. Information gained will be used to evaluate the impacts of low to moderate oil exposure and potentially repeated oil exposure on avian health and associated long-term survival and productivity. Study results will inform injury determination and quantification evaluations.

3.3 Endangered/Threatened Fish (1 assessment procedure)

Gulf Sturgeon (6.1) - This study will assess potential injuries to Gulf sturgeon resulting from the Oil Spill by evaluating fish movement and habitat utilization using ultrasonic telemetry and blood sample analysis. Gulf sturgeon will be captured, blood samples taken, and telemetry transmitters implanted in the summer and fall of 2011. In the spring of 2012, a second field effort will attempt to recapture and collect blood samples from previously tagged fish. Measures of exposure and potential injury will be made on the same samples to inform interpretation of exposure and predict toxicity to the Gulf sturgeon. Additional injury assessment will be based on cytogenetic and genomic responses observed in the same blood samples. Study results will assist in injury determination and quantification evaluations to Gulf sturgeon resulting from direct exposure to or habitat alteration by the Oil Spill and associated response activities.

3.4 Endangered/Threatened Mammals (1 assessment procedure)

Beach Mice Assessment (7.1) - This study will document Incident response-related disturbance to or destruction of the endangered and candidate beach mice species sand dune habitat in Alabama and Florida by mapping the current condition of dune habitat in areas where response activities occurred in known or potential beach mouse habitat. Currently occupied and potential mouse habitat areas will be surveyed because both are considered critical to the maintenance of this subspecies, and beach mouse population numbers and occupied habitat can vary over time. Disturbance and or destruction of beach mouse habitat could impede recovery of this species, and documentation of potential disturbance will be used to evaluate the impacts of spill-related response activities. This study will inform injury determination and quantification evaluations.

3.5 Other (7 assessment procedures)

Aerial Imagery (8.1) - This assessment activity will address imagery needs, provide technical support, and identify remote sensing products to be utilized case-wide. Certain TWGs (e.g., Shoreline, Submerged Aquatic Vegetation, Turtle,) have requested imagery to support the injury determination and quantification evaluations for specific resources that may have been impacted by the Incident. Procurement of aerial imagery with clearly defined technical specifications which meet the needs of the resource TWGs will be a key output of this study. While imagery from fall 2010 and spring 2011 already has been obtained, additional post-spill imagery (fall 2011 and spring 2012) is planned. This study also will include data interpretation and mapping for marsh, shoreline, and seagrass habitats. Resulting data and maps will inform the determination and quantification of injured habitats attributable to the Incident and associated response activities.

Response Injury and Sandy Beach Assessment (8.2) – The objective of this activity is to compile the various sources of information that may be used to assess injury to a variety of resources related to response actions on shoreline habitat. Shoreline response injury is an injury type separate from oil exposure and, in some cases, may significantly affect the recovery rates of different habitats and resources, even those that were not directly oiled. However, information potentially relevant to the evaluation of the temporal and spatial extent of response-related injuries is scattered among many organizations, usually not collected consistently, and has been difficult to obtain. Activities to be undertaken as part of this study include acquiring and organizing information on potential response injuries needed by the Sandy Beach sub-group of the Shoreline TWG to determine how best to use these data to quantify the extent and duration of

response injury, and working with the Bird and other TWGs to adopt/adapt similar approaches, as warranted.

Near Shore Benthic Prey Organisms (8.3) - This study will assess the extent to which benthic prey organisms located in foraging habitats important to biological resources of concern are contaminated with MC 252 oil. Although the flow of oil leaking into the Gulf ended in the summer of 2010, resources of concern could still be exposed to DWH oil, oil-dispersant mixtures and their byproducts via a contaminated food base. This study will include measurement of contaminants, specifically hydrocarbons and dispersants, in and on benthic organisms that are food items for biological resources of concern. This study is interconnected with and has been coordinated with other injury assessment efforts and will provide data on potential pathways of exposure to specific resources of concern, such as Gulf sturgeon, piping plover, Kemp's ridley and loggerhead sea turtles and groups of species with similar feeding strategies including shorebirds, diving ducks, and dabbling ducks. Study results will inform the pathway of exposure for these biological resources of concern.

JELA SAV Plan (8.4) - The objective of this study is to assess potential impacts on the Jean Lafitte National Historical Park and Preserve (JELA) submerged aquatic vegetation (SAV) community following the diversion of Mississippi River freshwater flows in response to the Deepwater Horizon Oil Spill. Freshwater flows were diverted from the Davis Pond Diversion to Lake Cataouatche, adjacent to JELA, to reduce the potential for oil intrusion into inland marshes. Comparison of data obtained from impacted and reference sites will inform injury determination. If injuries are confirmed, study data will provide a basis for injury quantification.

Expert Consultation (8.5) –Data needed to assess and quantify injury to natural resources of concern from the Deepwater Horizon Oil Spill are being generated by a series of pre-assessment and assessment procedures, many of which are cooperative between the Trustees and BP. As the NRDA proceeds, additional need for technical support and expert consultation may be identified by DOI and its co- Trustees for additional field work, laboratory and/or data analysis to support injury determination and quantification as well as the feasibility of possible restoration actions.

Quality Assurance and Quality Control Program (QA/QC) (8.6) – A DOI-wide Quality Assurance and Quality Control program to promote data quality, specifically in data accumulation, management, storage and integration into products resulting from DWH NRDA activities. This program will continue to work across all DOI projects as well as with other trustee quality and data management programs to promote consistency across the Deepwater Horizon NRDA.

Early Restoration Planning (8.7) – This activity includes technical support for participation in the early restoration process agreed to by the Trustees and BP in the April, 2011 *Framework for Early Restoration Addressing Injuries Resulting from the Deepwater Horizon Oil Spill*.

4.0 ENDANGERED/THREATENED TURTLES

4.1 Nesting and Hatchling Kemp's Ridley Sea Turtles

Purpose and Injury Assessment Need

Kemp's ridley turtles nest along the Texas shoreline in the Gulf of Mexico and many remain in the Gulf for their entire lives. This 2011 and 2012 study will assess potential exposure and injury to Kemp's ridley nesting adults, hatchlings, and eggs from DWH oil and dispersants. The assessment includes nesting female physical evaluations, satellite tracking of nesting female inter-nesting and post-nesting movements, blood samples and tissue biopsies collections from nesting females, collection of residual tissue samples from eggshells, non-viable eggs, and hatchlings, assessment of hatching and emergence success, and collection of nest sand samples. The samples collected during the study will be tested for potential egg and hatchling toxicity impacts and hatchling emergence success as a function of pre-discharge conditions and post-discharge concentrations of DWH oil, and on nesting females, hatchlings, eggs, and nesting substrate to determine if a relationship between exposure and injury exists (See Turtle Analytical Plan description, Section 5.4 below). Comparison of 2011 and 2012 data obtained from this study with similar data from the same area collected during pre-assessment in 2010 and earlier, prior to contaminant exposure resulting from the Deepwater Horizon Oil Spill, will inform injury determination, as will data obtained from the 2011 pre-assessment study. If injuries are confirmed, study data will provide a basis for injury quantification by, for example, using numbers of nesting turtles and/or hatchlings injured by the Incident.

This 2011 and 2012 assessment study is a continuation of Nesting and Hatchling Kemp's Ridley pre-assessment studies conducted in 2010 and ongoing in 2011. This Claim includes costs for a portion of the 2011 Assessment Costs and 2012 Assessment Costs. The Trustees have provided a copy of their proposed study plan to BP. However, there is not presently an agreed upon plan. At this time, BP has not agreed to participate in or fund the 2012 study, but the Trustees and BP have mutually agreed that the 2012 Nesting and Hatchling Kemp's Ridley Sea Turtle study will be revisited in early 2012.

Methods

The primary study area consists of two main portions of the Texas coastline: Bolivar Peninsula to Surfside Beach, and the Padre Island National Seashore. Specific methodologies used in each part of this plan are the same as those used in the previously-approved 2010 work plan, with a few modifications, including affixing satellite transmitters to 20 new adult nesting Kemp's turtles, using carapace swipes to test visible oil on turtles receiving satellite transmitters, collecting visible surface oil, taking blood samples from adult female turtles, collecting broken intact eggs that are not incubated, collecting sand samples from the nest cavity of tagged turtles, and using the satellite data collected to assess inter-nesting and post-nesting movements. (The 2010 pre-assessment plan is available at:

http://www.doi.gov/deepwaterhorizon/adminrecord/upload/Preassessment-Plan-to-Determine-Potential-Exposure-and-Injuries-of-Nesting-and-Hatchling-Kemps-Ridley-Sea-Turtles-9_7_10.pdf).

The study will consist of three data collection projects:

Nesting female assessments

Coastal surveys and standard identification tagging will be performed in accordance with methods used in the previously-approved 2010 work plan. Turtles will be examined for evidence of illness or tumors, and turtles found with visible oil, and turtles receiving satellite transmitters (up to 20) will undergo a carapace swab (not included in the 2010 work plan). Tissue, blood, and scute samples will also be obtained. Blood samples will be partitioned for analyses described in a separate analytical plan.

Nesting emergence and success

After nesting, all nests will be excavated, broken eggs will be collected and stored, and the balance of excavated eggs will be moved to a protected corral or to an incubation facility. After hatching and emergence, all remaining nest contents, including live and dead hatchlings and embryos will be collected and processed.

Sand surveys

Sand samples will be collected from the nest cavity for nests of telemetered females to determine exposure to oil.

Relationship to Other Activities and Data

This study is an addendum to the 2010 Pre-Assessment Plan to Determine Potential Exposure and Injuries of Nesting and Hatchling Kemp's Ridley Sea Turtles and Their Nests, as well as the continuation of the 2011 Nesting Kemp's Ridley Pre-assessment Addendum. It will collect comparable data to be used for a post-discharge assessment. This study is designed to be conducted as an adjunct to ongoing efforts on behalf of the Division of Sea Turtle Science and Recovery at the Padre Island National Seashore. Since 1986, the Padre Island National Seashore has conducted systematic studies of nesting sea turtles, including Kemp's ridley. Additionally, the data are similar to that collected in the DWH NRDA Loggerhead Nesting and Hatchling Pre-assessment Plan.

Coordination and Implementation

As mentioned previously, work within this study is designed to be conducted as adjunct to ongoing efforts on behalf of the Division of Sea Turtle Science and Recovery at the Padre Island National Seashore. The work will be conducted by a Principal Investigator (PI) from the NPS, who will coordinate with the USFWS, and use additional investigators as needed.

Budget

The Claim amount for this study is \$386,704 plus associated DOI personnel costs to implement and oversee the study.

4.2 Nesting and Hatchling Loggerhead Sea Turtles

Purpose and Injury Assessment Need

Loggerhead turtles nest along the Gulf Coast and often remain in the Gulf between nesting seasons and during the inter-nesting interval. This study will assess potential exposure and injury to loggerhead nesting adults, hatchlings, and eggs from Deepwater Horizon oil, dispersants, and response activities. The assessment includes nesting female physical evaluations, satellite tracking of nesting female inter-nesting and post-nesting movements, blood samples and tissue biopsies collections from nesting females, collection of residual tissue samples from eggshells, non-viable eggs, and hatchlings, assessment of hatching and emergence success, and collection of nest sand samples. The samples collected during this study will be tested for potential egg and hatchling toxicity impacts and hatchling emergence success as a function of pre-discharge conditions and post-discharge concentrations of MC252 oil, and on nesting females, hatchlings, eggs, and nesting substrate to determine if a relationship between exposure and injury exists. (See Turtle Analytical Plan description, below). Comparison of 2011 and 2012 data obtained from this study with historical data from the same area will inform injury determination. If injuries are confirmed, study data will provide a basis for injury quantification by modeling, for example, the number of nesting turtles and/or hatchlings injured by the Oil Spill.

This 2011 and 2012 assessment study is a continuation of Nesting and Hatchling Loggerhead Pre-assessment studies conducted in 2010 and ongoing in 2011. This Claim includes the costs associated with collecting and analyzing data for nesting, hatching and emergence success in Florida and Alabama as well as some other costs for the 2011 and 2012 studies. The Trustees have provided a copy of their proposed study plan to BP. However, there is not presently an agreed upon plan. At this time, BP has not agreed to participate in or fund the 2012 study, but the Trustees and BP have mutually agreed that the 2012 Nesting and Hatchling Loggerhead Sea Turtle study will be revisited in early 2012.

Methods

The study area includes beaches from the Texas/Mexico border to the Dry Tortugas, Florida, and along the beaches of Southeast Florida. In 2011, the primary study site is located in Baldwin County, Alabama, which includes the Perdue Unit of the Bon Secour National Wildlife Refuge, however, another location may be identified for work in 2012.

The study will consist of three data collection projects:

Nesting loggerhead assessments

Intensive nighttime surveys for nesting loggerhead turtles will be conducted at the study site at Bon Secour National Wildlife Refuge and adjacent private lands.

Satellite transmitters will be attached on up to 10 nesting turtles in Alabama. Five turtles will be fitted with Wildlife Computers SPOT5 satellite tags and up to five with Wildlife Computer Mk10 Fastlock GPS satellite tags (for a total of up to 10 satellite transmitters deployed), using established methods for sea turtle satellite telemetry (Seney and Landry 2008, Shaver and Rubio 2008, Hart et al. 2010). The Fastlock tags will be programmed to provide dive data, as well as to obtain GPS locations once per week.

The assessment will include a complete physical examination including examination of eyes and nostrils. Any lesions and abnormalities will be photographed and described on the data sheet. The nests used by these females will be marked and monitored throughout incubation. Three days after first signs of hatchling emergence, the nests will be excavated and up to 10 randomly selected unhatched eggs will be collected per nest and sent to the lab for processing and analysis.

During nest inventories after hatchlings have emerged, a sand core will be collected from the inside of the nest cavity.

Extent of potential exposure in nests in Alabama, Florida Panhandle, Southwest Florida, and Southeast Florida

In 2011 a total of 50 nests will be selected randomly from the study area beaches in Alabama, the Florida Panhandle, Southwest Florida, Dry Tortugas, and Southeast Florida (Figure 2). Following hatchling emergence, up to 10 random unhatched eggs per nest will be collected from each of those randomly selected nests and sent to the lab for processing and analysis. Frequency and degree of deformities in hatchlings (dead and alive) and embryos will be photographed and described in the field notes.

Nesting, hatching and emergence success

As part of the ongoing Index Nesting Beach Survey (INBS) program, which occurs independently of NRDA, in 2011 and 2012, from May 1 through August 31, daily nesting surveys will be conducted on the Gulf of Mexico beaches in Florida that are part of the INBS program (St. Joseph Peninsula State Park, Panama City Beach, and Santa Rosa Island). These beaches have consistent nesting survey and nest inventory data for the past 5 years. Also in 2011 and 2012, from May 1 through August 31, daily nesting surveys will be conducted on beaches in Baldwin County, Alabama. All nests will be marked and recorded by GPS. Any nest that has been depredated and/or disoriented will also be recorded.

As part of the NRDA, the Trustees will compile and analyze data collected by the participants in the INBS program and in Baldwin County, Alabama, to assess the nesting, hatching and emergence success over time. In addition, analysis of nesting patterns and simultaneous response activities may also show impacts as well as an analysis of the amount of beach that is unsuitable for nesting turtles over a period of time. Ongoing response activities will continue to be recorded.

Relationship to Other Activities and Data

Samples collected in 2011 and 2012 from nests and associated turtles will be compared to similar historical data from the same area, collected prior to exposure to DWH oil and dispersants, specifically, the level of PAHs in unhatched eggs can be compared to levels found in Alam and Brim (2000) in unhatched eggs in the Florida panhandle.

Data collected in 2011 and 2012 concerning nesting, hatching, and emergence success will be analyzed and compared with data collected prior to the Deepwater Horizon Oil Spill. Analysis of impacts of response injury on sea turtle nesting will be coordinated with the Response Injury

and Sandy Beach Assessment (described in Section 8.2). Injury determination will use data from other NRDA activities, as well as maps and other data collected and logged during recovery efforts.

Coordination and Implementation

Work plan activities will be conducted through the nesting and hatching seasons (approximately June 1 through August 31) of 2011 and 2012. Trustee representatives from the USFWS in Alabama, the Bon Secour National Wildlife Refuge, and investigators from U.S. Geological Survey (USGS), and the Florida Fish and Wildlife Conservation Commission, will implement this study.

Budget

The Claim amount for this study is \$248,090 plus associated DOI personnel costs to implement and oversee the study.

4.3 Turtle Analytical Plan

Purpose and Injury Assessment Need

Building on substantial historical data, the qualitative and quantitative nature of sea turtle use of northern Gulf of Mexico beaches for nesting purposes is well documented, allowing for assessment of injury-associated changes in beach use, nesting and hatching success. To quantify exposure and health effect endpoints, laboratory analyses will be used to provide data outputs that will be related with observed nesting data through correlative, dose-response and cause-effects relationships. The relationships will explain observed nesting injuries as well as allow extrapolation to approximate overall extent of the impacts of the Incident.

This study will assess exposure and injuries in sea turtles by analyzing a variety of matrices collected as part of the Kemp's ridley and loggerhead nesting studies.

Methods

Analyses will be performed on a variety of tissues and materials collected as part of the 2010 and 2011 Nesting and Hatchling Loggerhead Sea Turtle Plans, the 2010 and 2011 Nesting and Hatchling Kemp's Ridley Sea Turtle Plans, as well as samples collected from translocated loggerheads nests in 2010. The samples include:

- Adult nesting female turtles (carapace wipes, blood and carapace and skin biopsies),
- Hatchling survivors (Chorioallantoic membranes (CAMs)),
- Mortalities (hatchling and late term embryo CAMs, residual yolk, liver, bile, muscle, gonads),
- Unincubated and unhatched eggs (pooled/composited egg contents of each type for each nest, separately); and,
- Nests (nest-associated sand).

Analyses fall into two classes, chemical and biological. Analyses for petroleum profiles and PAHs will provide exposure data while biochemical, physiological, anatomical and genetic data will tie exposure to lethal and sublethal injury.

Number and Extent of Nesting Females Potentially Exposed and Affected. A model will be developed by overlapping sea turtle satellite transmitter data with maps of the date and location of the MC252 oil in the water. Hind casting will be performed using satellite-tracking data for nesting loggerhead females tagged at study sites as part of the 2010 and 2011 loggerhead NRDA work plans, along with data in the Integrated Oil Spill Impact Model System (SIMAP). A similar approach will be used for data from Kemp's ridley females tagged at study sites as part of the 2010 and 2011 Kemp's ridley NRDA work plans. All four pre-assessment plans specifically accommodated the data needs for this approach. GIS will be used to overlay SIMAP and turtle data.

These modeling efforts will determine numbers and extent of nesting turtles that may have been exposed to MC252 oil during the heavy oiling period of the Incident. This effort will also inform the degree of exposure to loggerheads who were nesting during the Oil Spill. (Note: In 2010, the nesting Kemp's ridley females had already arrived in the vicinity of the nesting area on the Gulf coast of Texas and thus were not exposed to oil during the 2010 season). It will also provide insight into ongoing exposure of both species while foraging in petroleum contaminated areas. Models of the spatial and temporal potential for sea turtle petroleum exposure, when combined with actual data from incapacitated turtle collections during the Oil Spill, can provide data with which to inform injury determination.

Relationship to Other Activities and Data

This study will assess exposure and injuries in sea turtles by analyzing a variety of matrices collected as parts of the Kemp's ridley and loggerhead nesting studies. Study results will inform the determination and quantification of injured sea turtles attributable to the Oil Spill. Injured animals will be compared to both spatial and temporal reference data to establish quantitative background information. This Claim includes costs for analyzing available samples.

Coordination and Implementation

The Principal Investigator for this plan is a representative of the USGS Columbia Environmental Research Center. Other coordinators include trustee representatives from the NPS, and the USFWS. Additional investigators as needed will also conduct work under this plan. The Trustees estimate that this study would be implemented over approximately 12 months.

Budget

The Claim amount for this study is \$2,698,024 plus associated DOI personnel costs to implement and oversee the study.

5.0 BIRDS

5.1 Beach Habitat Carcass Persistence Study

Purpose and Injury Assessment Need

The objective of this study is to evaluate the daily persistence rates of carcasses on beaches in order to estimate the proportion of carcasses that persisted long enough to be found by Deepwater Horizon beached bird survey crews typically working at 3 to 4 day intervals from late May through September 2010. Carcass persistence studies have been undertaken as part of NRD assessment efforts for several oil spills in the U.S. (e.g., the *Selendang Ayu*, *Cosco Busan*, *Bouchard B-120*, *Kure*, *New Carissa*, *Exxon Valdez*, and *Nestucca* incidents). This study will inform injury quantification evaluations.

Methods

Carcasses of un-oiled birds of species similar to those found during beached bird surveys will be individually marked in ways not conspicuous to scavengers, but visible to researchers (i.e., carcasses will be tagged with poultry tags). Carcasses will be checked daily for six days, and then checked once more between 10 and 15 days after placement. Beached bird survey teams typically checked beaches every three days, and did not necessarily find every beached bird during a particular survey. The six days of daily observation planned for the carcass persistence study therefore span two ‘typical’ beached bird survey cycles (i.e., six days). One final observation will be made 10 to 15 days after placement to provide some information about longer term persistence.

Number and Type of Carcasses: This study is expected to use approximately 102 carcasses (17 transects, six birds per transect). No birds euthanized using chemical agents other than inhalant anesthetics or birds from disease-related wildlife mortality events will be used. Carcasses used for this study will be classified into small (<200g), medium (200-500g) and large (>500g) categories. 34 birds from each of the three size classes will be used, although this proportion may be adjusted if insufficient birds for one or more size class are available at the time the study is implemented. Carcasses will be intact and un-scavenged when placed on beaches. No gutted birds will be used.

Transect Selection: Birds will be placed on 17 transects, reflecting a range of beach habitat types. All of these transects were included in post-spill Beached Bird Surveys, and several were included in the Detection Probability (Searcher Efficiency) Study. If field teams determine during pre-study reconnaissance that logistics will allow incorporation of one or more additional transects, and sufficient carcasses are available, determination of specific transects to add will be made jointly by the Trustees and BP representatives.

Placement of Carcasses: Carcasses will be placed along the beach at random distances between the transect start and end (two km for most Beached Bird Survey transects). A wooden block with the associated bird’s identification number written on it in permanent marker will be placed under all carcasses to aid searchers in distinguishing between a rewash event and the removal of a carcass by a scavenger. Overall, one-third (34) of the carcasses will be placed in the low area

(wash zone), one-third at the wrack or high tide line, and the remaining one-third in the upper intertidal area. As noted above, bird sizes will be evenly distributed among small, medium and large size classes. The size (i.e., small, medium or large) and location (i.e., distance from transect start and position on the beach) for each carcass on each transect has been assigned randomly using the distributions described above.

Carcass Checks: Each transect will be checked daily to determine if carcasses are still present. The degree of scavenging and position on the beach will be noted on each visit, and carcasses will be photographed at each check. Carcass checks will continue until all carcasses are gone or at least 6 days have elapsed (two beach survey cycles). If a carcass is missing from the placement point, teams will search for it while checking for other transect carcasses, in case the carcass has been moved by a scavenger or rewashed up or down the beach. The area of the beach to be searched for “missing” carcasses should be the same as was searched during the Beached Bird Surveys (e.g., between the water’s edge and 5 m landward of the old wrack line). At a minimum, “missing carcass” searches should cover the portion of the transect between the carcasses located closest and farthest from the transect start on the prior day, plus 100 meters on either end.

Discovery of Oiled Dead Birds: In the event that a study team encounters a dead oiled bird, the appropriate protocol for collecting that carcass will be followed.

Study Teams: Five field teams will be required to conduct activities at the 17 transects planned for this study. Each field team will consist of at least one Trustee representative and one BP/ representative. Any deviation from this study team composition will be mutually agreed upon by both parties.

Relationship to Other Activities and Data

Data generated by this study, in combination with other pre-assessment data (e.g., Beached Bird Survey carcass counts and searcher detection efficiency data) will be integrated into the Beached Bird Model and assist avian injury quantification efforts.

Coordination and Implementation

Bird Study #1 (of which this effort is a supplement) has been coordinated with and supported by the Trustees and was conducted cooperatively with BP.

Implementation of this study will begin in early June 2011 and last approximately two weeks. (The Trustees and BP recently signed a modified work plan for this study, which increased the cost, and it is being conducted cooperatively. BP advanced the additional cost of the modified plan.)

Budget

The Claim amount for this study is \$244,000 plus associated DOI personnel costs to implement and oversee the study.

5.2 Marsh Edge Searcher Efficiency Study

Purpose and Injury Assessment Need

This study will evaluate searcher efficiency in marsh habitats, where factors such as vegetative cover/habitat and standing water may influence the ability of search teams to find bird carcasses. The study objective is to estimate carcass detection rates for survey/response crews searching for carcasses in marsh edge habitat.

Searcher efficiency studies have been undertaken as part of assessment efforts for several oil spills in the U.S., including the *Selendang Ayu*, *Citrus*, *Cosco Busan*, *Lukenbach*, *Kure*, and *New Carissa*. One of the major factors impacting the number of carcasses recovered in the study area on a given search is carcass-detection rate (also referred to as searcher efficiency), which is defined as the probability that a searcher will detect a carcass known to be on a beach or stranding area each time that area is searched (Byrd and Reynolds 2006a, Byrd et al. 2009). Because carcass-detection rates vary with a range of local factors, it is important to document detection rates on a site-specific basis (Van Pelt and Piatt 1995, Fowler and Flint 1997, Ford 2006, Byrd et al. 2009).

A boat-based beached bird survey was conducted along the edge of marshes supporting large numbers of wintering waterfowl as part of Pre-Assessment Bird Study #10 (Wintering Waterfowl Study). The majority of transects are along marsh edges and other areas where walking searches are not possible. Carcass-detection efforts are an integral part of the BBM, but are particularly difficult in the context of marshes or bayous which do not have a distinct shoreline. Rather than depositing in clearly defined areas which are relatively easy to search, dead birds may be scattered across large areas of open water, along the edges of vegetated islands, or within vegetated areas. While a searcher efficiency study was conducted for coastal and barrier island beach habitat (Pre-Assessment Bird Study #1A, beach habitat searcher efficiency study), a similar effort is needed to address unique conditions affecting visibility in marshes (including type and density of vegetation, search platform, etc.).

Results from this study will complement data collected pursuant to the marsh edge Carcass Persistence Study (see Section 5.8.4 of this document) and facilitate development of estimates of total avian mortality.

Methods

Study Area

Habitats to be sampled include vegetated (robust emergent vegetation) edges of bays, estuaries, and marshes accessible by motorized boat. The Wintering Waterfowl study focused on three areas where shoreline oiling impacts have been greatest (Mississippi River delta, Terrebonne Bay, and Barataria Bay) and reference sites (Atchafalaya River Delta and Marsh Island WMA/Vermilion Bay). The Searcher Efficiency study will focus on a subset of transects from these areas.

Sampling Design

Researchers generally have applied one of two methods for estimating carcass-detection rates of search teams: 1) experimentally placing marked carcasses on transects, which are then searched using “standard” methods and effort applied for that spill (e.g., Ford and Ward 2000); or 2) searching selected transects with “naturally” occurring carcasses multiple times and using a mark-recapture estimator to determine the likelihood of detection (e.g., see Byrd et al. 2009).

The Trustees will apply the former method (i.e., “carcass seeding”) for this Oil Spill. Unoiled carcasses obtained from government agencies, research organizations, and/or other sources will be subtly marked and placed in transects to be searched by survey teams without their knowledge. To the extent feasible, carcass species, size, condition, density, and pattern of placement will mimic conditions observed by spill survey teams. This method has the advantage of establishing a known number of carcasses to be found by survey teams. Initial Trustee evaluations of carcass availability suggest that sufficient, appropriate carcasses can be made available for this study.

Search teams that were used to survey marsh edge transects during the Wintering Waterfowl Study will be contracted for the search efficiency trials. Study implementation will closely follow standard operating procedures for: 1) bird preparation; 2) carcass distributions on transects; 3) deployment and retrieval of carcasses; and 4) data recording and chain of custody used for Pre-Assessment Bird Study #1A (beach habitat searcher efficiency study) with modification where appropriate for the unique habitat types. A detailed work plan will be developed prior to implementation of this study. For planning purposes the Trustees expect to include up to 50% of boat-based beached bird transects (or 20 total). The marsh edge beached bird transects searched as part of Pre-Assessment Bird Study #10 encompass two dominant vegetation types (*Spartina* and *Phragmites* dominated freshwater/brackish marsh) and two types of boats (or search platforms) were used (i.e., small skiff/bay boat and mud boats). Study transects will be selected to ensure each dominant vegetation type and platform are represented. Carcass placement densities will be determined based on information available to date. To the extent feasible, carcasses made available for this study will reflect the range in size and scavenging condition actually observed by beached bird survey teams.

Carcasses will be subtly marked (e.g., small unique identifier on plastic leg band for identification if moved) to minimize attention from the searcher. A small wooden board (or other unobtrusive material affixed to the placement site) will be placed directly under each carcass to mark the original location of the carcass and display pertinent information regarding the purpose of the study and the carcass placement. It is possible that laminated cards will be affixed to the birds themselves as well as identifiers. All carcasses will be recovered after search teams complete study transects. Missing carcasses, if any, will be noted. Search teams will use their standard protocols for conducting surveys used in Pre-Assessment Bird Study #10.

Relationship to Other Activities and Data

As noted above, this study is a complement to the Wintering Waterfowl Study (Pre-Assessment Bird Study #10) and along with the marsh edge carcass persistence study (described in Section 5.8.4) will provide data that will assist in the estimation of total avian mortality due to the spill. Similar studies have been developed to address searcher efficiency and avian carcass persistence

in beach habitats. Because of important differences between beach and marsh edge habitat that can affect searcher efficiency and carcass persistence, studies are needed for both habitat types.

Coordination and Implementation

Pre-Assessment Bird Study #10 specifically highlighted the potential need for the proposed effort as indicated in the work plan (signed by Trustee representatives and BP). The search efficiency study is expected to be implemented in late 2011/early 2012 when field search conditions (e.g., wind, wave height, etc.) that could affect the probability of detection will likely be comparable to those experienced during actual transect surveys for Pre-Assessment Bird Study #10.

Budget

The Claim amount for this study is \$198,000 plus associated DOI personnel costs to implement and oversee the study.

5.3 Marsh Edge Carcass Persistence Study

Purpose and Injury Assessment Need

This study will evaluate carcass persistence in marsh habitats, where factors such as vegetative cover/habitat and standing water may influence scavenging and decomposition, resulting in carcass persistence that differs from that determined along open beach habitats. The study objective is to estimate daily persistence rates of carcasses on marsh edges in order to estimate the proportion of carcasses that persisted long enough to be found by survey/response crews.

Carcass persistence studies have been undertaken as part of assessment efforts for several oil spills in the U.S., including but not necessarily limited to the *Selendang Ayu*, *Cosco Busan*, *Bouchard B-120*, *Kure*, *New Carissa*, *Exxon Valdez*, and *Nestucca*. Methodologies and results from these efforts provide context for the protocols proposed as part of Deepwater Horizon NRDA efforts.

There are few places in deltaic Louisiana where the transition from open water to walkable shoreline is not separated by expansive stands of emergent plants, leaving the vast majority of habitats inaccessible to anything but shallow draft boats, airboats, or aircraft. As part of response activities, Wildlife Ops and LE personnel collected live oiled and dead birds yielding data that will inform estimation of carcass deposition rates in these areas. Additional focused marsh edge searches were implemented as part of Pre-Assessment Bird Study #10, which involved a boat-based beached bird survey that was conducted along the edge of marshes supporting large numbers of wintering waterfowl in January 2011. A study to evaluate the persistence of carcasses along the marsh edge is needed to refine mortality estimates based on carcasses found in marsh habitats.

Methods

Study Area

Habitats to be sampled include vegetated (robust emergent vegetation) edges of bays, estuaries, and marshes accessible by motorized boat. Persistence rates will be assessed in areas/habitats where significant bird carcass recoveries by Wildlife Ops teams occurred in 2010 but beached bird surveys under Bird Study #1 were not conducted (these areas primarily include non-walkable habitats or beaches with restricted NRDA team access due to response activities). The Wintering Waterfowl study focused on three areas where shoreline oiling impacts have been greatest (Mississippi River delta, Terrebonne Bay, and Barataria Bay) and reference sites (Atchafalaya River Delta and Marsh Island WMA/Vermilion Bay). The marsh edge persistence study will focus on a subset of transects from these areas.

Sampling Design

Given the potential variability in carcass removal rates, and the lack of previous studies in the Gulf region focused on marsh edge habitats, site- and habitat-specific studies are needed. Previous studies summarized above primarily focused on carcass deposition and persistence on walkable or “hard” beaches; accordingly, it will be necessary to adapt these approaches to the unique constraints of marsh edge habitats.

Carcasses of un-oiled birds of species similar to those found on beached bird surveys will be individually marked in ways not conspicuous to scavengers, but visible to researchers (e.g., carcasses can be tagged with poultry tags). Carcasses will be checked daily for six days, and then checked once more after 10 to 15 days. The return rate of Wildlife Ops teams was not necessarily fixed; however, it is likely that the observation period proposed for the carcass persistence study spans a minimum of two searches for these crews. Beached bird survey teams conducting Bird Study #10 typically checked marsh edge transects every three days, and did not necessarily find every beached bird during a particular survey. Accordingly, the six days of daily observation encompasses two beached bird survey cycles (i.e., six days), and one final observation 10 to 15 days after placement to provide some information about longer term persistence.

Un-oiled carcasses obtained from government agencies, research organizations, and/or other sources will be subtly marked with unique identifiers. Initial Trustee evaluations of carcass availability suggest that sufficient, appropriate carcasses can be made available for this study. To the extent feasible, carcasses made available for this study will reflect the range in size actually observed by Wildlife Ops crews and Bird Study #10 beached bird survey teams. Marsh edge beached bird transects searched as part of Bird Study #10 include two dominant vegetation types (*Spartina* and *Phragmites* dominated freshwater/brackish marsh); similar habitats were searched as part of the Wildlife Response Operations. For planning purposes we expect to be able to include up to 50% of available transects (or 20 total) in the study effort. These can be systematically selected from the pool of accessible (based on logistics and permission) marsh edge transects included in the boat-based beached bird survey or Wildlife Ops track lines that were systematically searched.

A minimum of six carcasses will be placed on each transect (with replicates for each of three size classes, depending on carcass availability). Carcasses will be placed at random intervals along the marsh edge so that the distance between successive carcasses is a uniform random variate. Specific details regarding the spacing and placement of carcasses relative to realistic beaching scenarios and tidal conditions will be detailed in a standard operating procedure to be developed.

A fixed marker will be placed at the site of carcass deployment to aid searchers in distinguishing between a rewash event and the removal of a carcass by a scavenger. Carcasses will be checked daily to determine continued presence. The degree of scavenging and position will be noted on each visit, and carcasses will be photographed at each check. Carcass checks will continue until all carcasses are gone or at least 6 days have elapsed (two beach survey cycles). The results of the carcass drift study (Bird Study #1D, proposed) will inform whether it is possible to resight carcasses that have rewash in the study area. The area of the marsh edge to be searched for “missing” carcasses will be determined based on carcass drift study results and will consider the search area of both the marsh edge boat-based Beached Bird Surveys and Wildlife Ops activities, when appropriate.

Relationship to Other Activities and Data

As noted above, this study is needed refine mortality estimates based on carcasses found by Ops and Law Enforcement personnel and boat-based beached bird surveys conducted along the edge of marshes supporting large numbers of wintering waterfowl during January 2011 (Pre-Assessment Bird Study #10). A similar carcass persistence study plan has been developed for beach habitat (Pre-Assessment Bird Study #1C, Carcass Persistence Study), and is planned for implementation in summer 2011. Substantial differences in habitat types and associated scavenger species necessitates a companion effort in marshes where bird carcasses were recovered.

Coordination and Implementation

Pre-Assessment Bird Study #10 specifically highlighted the potential need for the proposed effort by indicating in the work plan (signed by Trustee representatives and BP) that a supplement would be developed in the future to address persistence if warranted. The Trustees will cooperatively develop a detailed study work plan for the persistence study. The Trustees plan to implement the marsh edge persistence study in summer 2011. Field efforts for this study can be completed within a single month.

Budget

The Claim amount for this study is \$200,000 plus associated DOI personnel costs to implement and oversee the study.

5.4 Carcass Drift Study

Purpose and Injury Assessment Need

This study will use radio telemetered bird carcasses to determine the movement patterns and persistence of floating carcasses before they are beached, sink or are eaten. Carcasses will be tracked until they are beached or until their radio signals terminate, indicating that the carcass has either sunk or been eaten. As a control on transmitter failure, ‘dummy’ carcasses designed to float similarly to birds, but not subject to sinking or scavenging, also will be tracked.

The Beached bird model (BBM) provides a methodology for estimating the proportion of beached birds that are recovered, but does not provide insight as to the fate of carcasses prior to beaching. The issue of birds that are lost before beaching arises regularly, and has been addressed in damage assessments for the *Apex Houston*, *Puerto Rican*, *Nestucca*, *Exxon Valdez*, *Citrus*, and the *S.S. Jacob Luckenbach* incidents. For the *Nestucca*, *Exxon Valdez*, and *Luckenbach* incidents, VHF transmitters were attached to both bird carcasses and to “dummy carcasses” released at sea. Carcasses drifting at sea may become waterlogged and sink or be consumed by scavengers before they come to rest on the shoreline. The BBM relies upon beached carcasses to estimate total mortality. This study is designed to estimate the likelihood that birds dying at sea would be beached and thus be accounted for by beached bird surveys and the BBM.

Methods

Study Area

The area within which the carcasses and dummies will be deployed will include the coastal and nearshore region extending from about Terrebonne Bay (91° 00' W), Louisiana, to Gulf Shores (87° 00' W), Alabama. Generally, deployments will occur within ten nautical miles from shore. However, the carcasses or dummies may drift to a larger area; therefore, the area within which the radiotracking will occur could be larger than the deployment area. Thus, explicit limits for the overall study area will not be defined a priori and may be adaptively expanded or contracted as needed.

Carcasses

Investigators will use freshly salvaged (non-frozen) bird carcasses collected from pre-existing sources such as airport animal control programs. Gull species will be the primary species used in this study. However, if opportunities arise to obtain appropriate carcasses of other spill-relevant species (e.g., northern gannets, common loons, pelicans, terns, etc.), these carcasses may be used as well.

Dummies

Dummies will be constructed so that they float in a manner similar to carcasses in terms of their response to wind and current conditions. Investigators will use plastic water bottles encased in neoprene, with the amount of water inside the bottles adjusted so that the dummies simulate the floating behavior of real carcasses. Before a release of carcasses will occur, a few representative carcasses will be “float tested” and used as models for assembling the dummies for that release batch.

Transmitter Assemblies

Investigators will use VHF transmitters with ranges of approximately 20-40 km and battery lives of 4-8 weeks. Transmitters will be enclosed in small high density foam 'barges' using epoxy and attached using stainless steel wire to the upper legs of carcasses or to reinforced eyelet holes on the dummies. Transmitter barges will be constructed so that they are nearly neutrally buoyant and will be pulled down underwater by sinking carcasses.

Public Outreach and Involvement

Persons not affiliated with the implementation of this study (e.g., conservation officers, beach-going citizens, etc.) may encounter transmitted carcasses or dummies in the field. To help prevent these persons from accidentally interfering with the study, some degree of public outreach regarding the implementation of the drift study may be necessary. The Trustees will determine the extent of advanced notice that should be provided within the study area. At a minimum, the transmitter barges will be marked with a unique identifier and phone number (e.g., USFWS Fairhope NRDAR Office) that can be called to report found carcasses or dummies.

Release of Carcasses and Dummies

Three release events will occur over an eight-week period during July and August 2011. At each release event, 75 carcasses and 25 dummies will be individually placed on the water from a hovering helicopter at random release points within areas that contained the highest live bird densities during similar time periods in 2010, based on aerial surveys carried out during 2010. The intent is to release carcasses/dummies in the offshore areas containing the highest densities of seabirds assuming that these were the areas where seabirds were most likely to have died during the spill if they died while at sea. Areas of potential carcass/dummy deployment include offshore as well as within relatively enclosed bays (e.g., Terrebonne Bay).

Radio Telemetry Tracking

Tracking will be carried out from aircraft, boats, and on foot as appropriate. Investigators will deploy two dedicated aircraft and two ground based tracking crews. Aircraft will fly the shoreline of the study area on a regular basis in order to determine which carcasses and dummies have beached and which are still at sea. Transmitters on the beach or nearshore will be located as precisely as possible, probably within 10m or less. Whenever possible, ground crews will attempt to make visual contact with the carcass or dummy in order to determine and record its condition. Carcasses will be left on beaches in order to determine the likelihood of rewash (following the marker block technique described in the Carcass Persistence Study – Bird Study #1C). At the end of the study, any retrievable transmitters and their associated barges will be collected from the field.

Relationship to Other Activities and Data

Two pre-assessment studies, Beached Bird Study (Bird Study #1) and Wintering Waterfowl Study (Bird Study #10) included systematic surveys for carcasses on walkable “hard” beaches. The Waterfowl Study also surveyed marsh edges by boat. This Carcass Drift Study will address the fate of carcasses drifting offshore of both shoreline habitats, which will inform development of estimates of Oil Spill-related avian mortality.

Coordination and Implementation

This effort will provide information to aid in the evaluation of results of carcass surveys conducted as part of the Beached Bird Study #1/1A conducted in 2010. The Beached Bird Study was coordinated with and supported by the Trustees and was conducted cooperatively with BP. Field effort for the 2011 Carcass Drift study is tentatively planned for July and August 2011. The Trustees have provided a copy of their proposed study plan to BP. However, there is not presently an agreed upon plan.

Budget

The Claim amount for this study is \$1,076,000 plus associated DOI personnel costs to implement and oversee the study.

5.5 Colonial Waterbird Photo Census and Analysis of Oiling and Survival Data

Purpose and Injury Assessment Need

A pre-assessment photographic census of colonial waterbirds on breeding colonies in 2010 and 2011 collected data on the abundance of seabird and coastal wader colonies in the Gulf of Mexico. In this activity, colony photographs from 2011 will be analyzed and compared to 2010 data to perform a Before-After/Control-Impact (BACI) analysis to compare the numbers of nesting birds present in the colonies between 2010 and 2011. In addition, as part of this activity these abundance data will be integrated with other pre-assessment study data that address estimation of the percentage of visibly-oiled birds and estimation of mortality rates of oiled adult birds. This study will inform injury quantification evaluations.

Methods

Study Area

Waterbird colonies and roost sites where oiling has been recorded (by personnel from wildlife response, refuges, wildlife management areas, parks, SCAT teams, or other sources) have been surveyed along the Louisiana coast in areas where observations were made from a boat or on foot at an appropriate distance to avoid disturbance. Outside this intensive initial focus area in Louisiana, along the coasts of AL, MS, and FL, a sample of colonies has been monitored at a lower density. A reference area outside the of the oil spill zone has been selected for telemetered birds.

Task 1: Colony photographic census

Aerial surveys will be conducted in 2011 to repeat the May/June 2010 photographic census of active seabird and coastal wader colonies in Louisiana, Alabama, Mississippi, and the Florida panhandle. Colony photography will be made using a Partenavia Observer. The Partenavia is a twin engine high wing aircraft that seats 4 (or 5 on a limited basis) passengers. Colonies will be photographed in multiple frames using high resolution digital cameras equipped with telephoto lenses. These photographs are sufficiently detailed that the postures and species of relatively small birds such as terns can usually be distinguished. Colony locations, altitude, track line, and photographic frame numbers will be recorded on a computer/GPS system. When engaged in colony photography, the aircraft will remain at an altitude of 600' ASL or more at all times to avoid any flushing behavior or disturbance on the part of nesting or roosting birds. Nest sites and attendant adults will be counted using imaging software adapted specifically for this purpose.

Photographs will be processed (“dotted”) using image analysis software developed by Media Cybernetics. Results will consist of screen captures of dotted images and summary statistics of the images provided, including the following:

- 1) Total number of individuals of each species at each colony.
- 2) Total number of “sites” (nest and/or territorial bird or pair) of each species at each colony throughout the survey area.
- 3) Categorized assessment of Brown Pelican nests at each colony throughout the survey area. Categories may include: well-built nest, nest with chicks, poorly-built nest, abandoned nest, empty nest, and brood (chicks not attended by an adult and outside an obvious nest).
- 4) Total number of chicks of each species at each colony in the central area (Atchafalaya Bay, LA to Apalachicola, FL).
- 5) A quantitative and qualitative assessment of oiling at colonies (number of individuals of each species affected, age classes of affected individuals, extent of oil at colony, presence of boom, etc.).

After completing the analysis of the 2011 data, a BACI analysis will be performed on the 2010 and 2011 data to compare the numbers of nesting birds present in the colonies between 2010 and 2011.

Task 2: Colonial Waterbird Oiling Rate and Survival Analyses; Coordination on LOBM Analyses

Data collected for the Pre-Assessment Bird Study #4 (Estimating Oiling and Mortality of Breeding Colonial Waterbirds) that address estimation of the percentage of visibly-oiled birds and estimation of mortality rates of oiled adult birds via radio and satellite telemetry will be compiled and temporally and spatially analyzed prior to incorporation into the LOBM. Similarly, the telemetry data collected for Bird Study #4 will be analyzed to estimate survival rates for each tagged species to facilitate incorporation into the LOBM.

Relationship to Other Activities and Data

As noted above, as part of this study, aerial surveys will be conducted in 2011 to repeat the pre-assessment May/June 2010 photographic census of active seabird and coastal wader colonies in Louisiana, Alabama, Mississippi, and the Florida panhandle. This study also will integrate data from other pre-assessment studies to facilitate integration with the LOBM.

Coordination and Implementation

The study is expected to be conducted over the next 12-18 months, although the timing is contingent upon completion of other avian-related assessment activities.

The Trustees have provided a copy of their proposed study plan to BP. However, there is not presently an agreed upon plan.

Budget

The Claim amount for this activity is \$853,000 plus associated DOI personnel costs to implement and oversee the study.

5.6 Pelagic Oiled Bird Photo Evaluation

Purpose and Injury Assessment Need

This project seeks to reduce uncertainty in the oiling rate observation data collected during the pelagic bird surveys of Pre-Assessment Bird Study #6 (Estimating Oiling Rates Among Pelagic Birds Using Ship Based Surveys) by evaluating birds in photographs taken during the pelagic surveys, a technique that has revealed higher oiling rates than observed by strictly visual, real-time observations of birds in the field. Bird Study #6 involved surveys of pelagic birds (density estimates and oiling observations) in the Gulf of Mexico to generate data for use in the LOBM. This work only included field activities to count birds and visually evaluate the density of, and degree of oiling on, birds at sea from June 2010 through June 2011. No data analysis or report writing was included in that work.

At least 900 photographs were taken of the birds observed during the implementation of Bird Study #6, and upon inspection, the photographs revealed evidence that many more birds were oiled than were detected by visual, real-time field observations. This study will fund: 1) the systematic review of all the photographs collected during Bird Study #6; 2) the input of these data into the USFWS database; 3) data analysis for Bird Study #6, including statistical estimation of the number of seabirds present in the spill zone of the Gulf of Mexico during the spill and potentially exposed to DWH oil; and 4) coordination with R. G. Ford Consulting to incorporate the data from Bird Study #6 into the LOBM.

Methods

Study Area

The study area for the pelagic surveys includes the entire U.S. Gulf Coast, from the Dry Tortugas to the Texas-Mexico border and the ocean offshore north of an imaginary line drawn between the Texas-Mexico border and the Dry Tortugas.

Evaluation of Photographs

Ornithologists knowledgeable in pelagic bird plumage variations will evaluate the photos collected during the implementation of the pelagic surveys and score them using the same oiling categories as used for the visual observations conducted in the field.

Data Analysis

Data analysis will include the statistical estimation of the total number of seabirds, grouped by species or similar categories, present in the spill zone of the Gulf of Mexico during the spill and potentially exposed to DWH oil. This effort will merge the data on bird density and oiling observations. Seabird estimates and oiling incidences may be calculated for geographic sub-areas within the spill zone or calculated for several time periods, if appropriate. This activity also will include coordination with R. G. Ford Consulting to incorporate the data from Pre-Assessment Bird Study #6 into the LOBM and the overall bird mortality estimate.

Relationship to Other Activities and Data

As noted above, this study is a follow-on to Pre-Assessment Bird Study #6, and will provide additional evaluation of photographic data, data analysis and integration with the LOBM.

Coordination and Implementation

This study will begin immediately after funding is committed, and is expected to be conducted over a period of approximately six months.

Budget

The Claim amount for this study is \$72,000 plus associated DOI personnel costs to implement and oversee the study.

5.7 Secretive Marsh Bird Helicopter Calibration

Purpose and Injury Assessment Need

As part of the Secretive Marsh Bird Study (Pre-Assessment Bird Study #3), helicopter transect surveys were undertaken in Louisiana in August and September 2010 to collect data on densities of secretive marsh birds. These surveys were conducted in areas not accessible on foot. Surveys were also conducted in areas in which standardized marsh bird call-back surveys were employed to help corroborate those results. Data collected under that study will assist in the estimation of injuries to secretive marsh birds exposed to MC252 crude oil, and will be integrated into the LOBM for marsh birds.

This study will employ additional helicopter surveys to gather data to assess helicopter observer detection probabilities (i.e., ' P ' and ' w ' as defined below). More specifically, the Distance Sampling method (Buckland et al., 2001) will be used to estimate local densities and abundance of secretive marsh birds using Secretive Marsh Bird Study (Bird Study #3) helicopter survey data. This method requires a detection function that describes the likelihood of sighting birds along transects flown. Documentation of secretive marsh birds via helicopter surveys relies heavily on visual observations as birds flush from vegetation. The detection function for these surveys therefore includes (1) the probability of observing a bird (i.e., flushing from vegetation) in the field of view of helicopter surveyors (P), and (2) the probability of observing a bird at varying perpendicular distances from the transect mid-line to birds sighted (w). Using this detection function will enable estimation of the proportion of birds missed by surveys (Thomas et al, 2002), increasing the accuracy of local density estimates.

Methods

Study Area

Helicopter surveys will be conducted in southern Louisiana marshes following transects surveyed in 2010 with the exception noted below. These areas include Biloxi Marsh and other representative areas along the coast, barrier islands, shorelines at Pass a Loutre Wildlife Management Area (WMA), Bay Jimmy in Barataria Bay and U.S. Army Corps of Engineers

(USACE) property along the Southwest Pass of the Mississippi River. Flight methods will follow those used in the Secretive Marsh Bird (Pre-Assessment Bird Study #3) work plan. Transects will follow those used in 2010 dominated by (1) *Spartina* marsh and (2) broken stands of *Phragmites* mixed with other vegetation such as *Sagittaria*, *Typha*, *Eleocharis*, *Bacopa*, and *Lathyrus* (Figure 1). Helicopter surveys of strict monocultures of *Phragmites* in 2010 did not yield significant secretive marsh bird sightings. This habitat will therefore not be included in this study.

Sampling Design

Approximately seven helicopter days will be required. Calibration flights will follow methodology used for 2010 surveys. These include flying over 200m wide strip transects for interior marsh and 130m strip transects along shorelines. Flights will be made at 12-16 kts ground speed. A qualified biologist observer will be on the port side of the helicopter to count birds in the 180 degree view from the midline of the front of the helicopter to the midline of the rear of the helicopter. The pilot on the starboard side of the helicopter will cover a 90 degree view from the midline at the front of the helicopter to the starboard side. Two rear-facing observers will scan the approximately 180 degree view from the helicopter mid-line to the side, below and behind the helicopter, where the forward facing observers leave off. Seat location of the ARRK system equipment and rear-facing observers will be optimized to enhance rear-facing observations. Observer eye levels will be approximately 5m off the ground during surveys. Automated route reconnaissance kit (ARRK) video cameras will be attached to the underside of the helicopter. Video cameras will be set at approximately 4m off the ground during surveys and will face forward, covering a 180 degree view forward from the helicopter. Given placement, lens angle and survey height, video cameras will end up recording a strip transect width of approximately 60m. The two rear-facing observers will also be operating the ARRK.

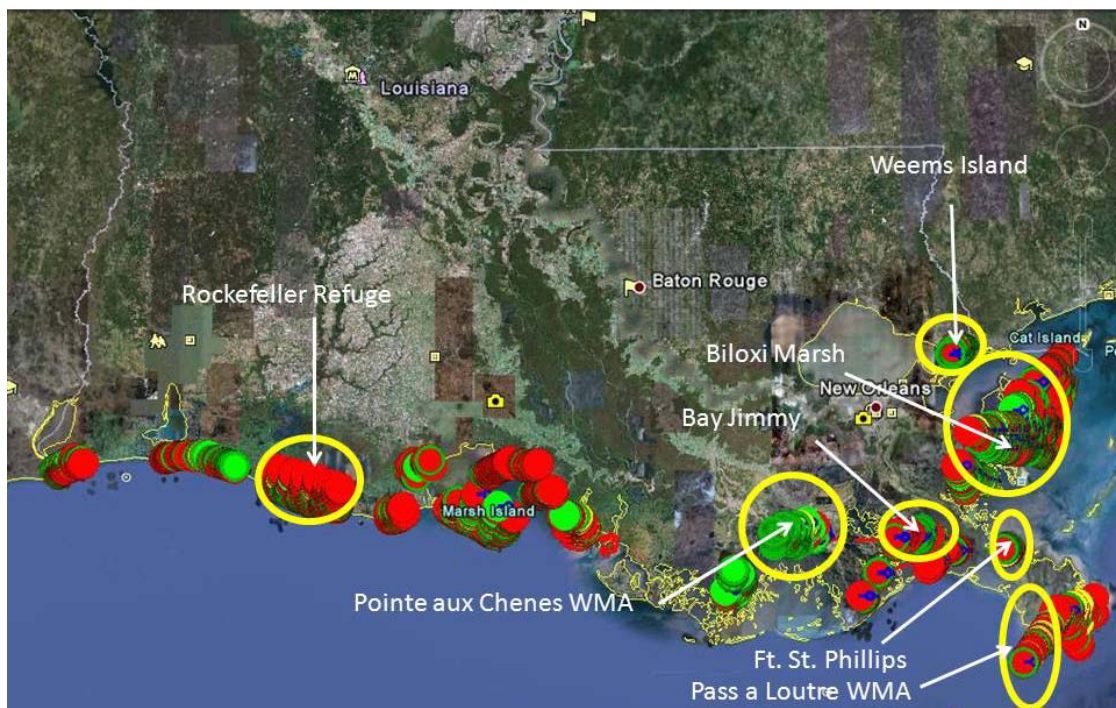


Figure 1. Proposed secretive marsh bird helicopter calibration survey transect areas. Red and green dots indicate locations of 2010 flight transect grids.

Goal 1: Probability of sighting a bird on a transect (P):

Documentation of secretive marsh birds via helicopter surveys relies heavily on visual observations as birds flush from vegetation. The probability of sighting a bird on a transect can be negatively affected by 1) birds flushing backward from the helicopter, or 2) birds not flushing. Because original surveys were focused mainly to the front and side of the helicopter, birds that flushed from underneath or behind the helicopter were difficult to observe, potentially reducing the overall count. Calibration flights in this plan will use the same ARRK video camera system (e.g., 3 forward facing cameras) as was deployed in 2010, with the addition of two rear-facing observers looking out the side rear doors in an attempt to record birds flushing from under and behind the helicopter to develop this estimate of potential error in 2010 surveys.

Rails are known to run under vegetation on trails instead of flushing to the air to evade a helicopter. The percentage of the population which does this is unknown and difficult to estimate or model. Without this calibration, final density estimates would be expected to be an underestimation of the true abundance of rails. Developing an estimate of the number of birds which do not flush during helicopter surveys necessitates the use of a known population of birds present. This will be accomplished by equipping at least ten rails in the area to be surveyed with radio transmitters and colored markers (i.e., patagial wing tags and/or tail streamers)¹. Helicopter observers will then record whether these birds were observed during specific surveys encompassing their known locations based on radio telemetry. Percentage of times these birds were observed during flushes will be used to estimate the population of rails present but not counted.

Goal 2: Perpendicular distance from the transect line to the bird sighted (w)

The location of a bird relative to the transect mid-line can affect the probability of an observer detecting it. This probability decreases as the bird's distance from the midline increases. To calibrate observer estimates of distances to known targets, targets will be posted at various known distances from transect flight lines (w). These targets may be made from tin foil wrapped over cardboard life-sized bird silhouettes on stakes spray painted cryptic colors similar to birds. Flight crews will repeatedly record estimated distances and angles to targets from the helicopter by eye independently during transect flights. (The helicopter intercom system will not be used to relay distances to eliminate influence and bias among observers.) These fly-by drills on targets will be repeated until group competency and accuracy is high. The goal is to have all four observers' visual distance estimates agree and be accurate within a 95% confidence interval. Practice on live birds will then be employed by verifying ocular distance estimates with a laser range finder. A return to the targets will be made to test observer accuracy each day before flights and again at day's end for a total of ten tests. Approximately an hour each day for 5 days will be dedicated to these simulations and percent error rates will be determined.

Data Analysis

¹ Official USFWS volunteers will conduct bird captures for color marking and transmitter attachments.

Data will be analyzed by the Principal Investigator using DISTANCE SAMPLING (Buckland et al., 2001 & 2004). Analyses will use logical representative groupings of data in the transect grids flown in 2010 to arrive at density or abundance of rail (king and clapper rails will be lumped together) and seaside sparrow populations. Density estimates will be determined in spill affected areas, adjacent areas and reference sites such as Pointe-aux-Chenes WMA and Rockefeller Refuge.

Relationship to Other Activities and Data

As noted above, this study is a follow-on to Pre-Assessment Bird Study #3, and will provide additional data needed to evaluate secretive marsh bird detection probabilities by helicopter observers.

Coordination and Implementation

USFWS and the USGS will lead this study. If feasible, the helicopter flights will occur in late summer/early fall 2011, the same time of year as the original surveys. Data processing and analysis is expected to occur over a four to six month period after the flights.

Budget

The Claim amount for this study is \$156,000 plus associated DOI personnel costs to implement and oversee the study.

5.8 Supplement to Gulf Coast Breeding, Beach-Nesting Bird Population Surveys

Purpose and Injury Assessment Need

This study will evaluate potential Incident-related shorebird injuries. Beach-nesting birds will be re-surveyed in 2011 throughout the four state region impacted by the events of the 2010 Deepwater Horizon Oil Spill. Surveys will locate nesting sites and enumerate the breeding populations of beach-nesting birds in order to evaluate shorebird injuries that may have occurred since pre-spill breeding surveys conducted in 2010.

Methods

Study Area

The survey coverage area spans all coastal beach-nesting bird habitat within the four state region of Alabama, Mississippi, Louisiana, and Texas (to Galveston Island) impacted by the Deepwater Horizon Oil Spill. The coverage area includes all mainland habitat, barrier islands, delta islands, and dredge spoil/restored islands which support solitary beach-nesting birds.

Survey Methodology:

The 2011 surveys will duplicate the CBC 2010 beach-nesting bird census and data collection methodology. Comprehensive, standardized, breeding surveys will be conducted from May 1 through late June 2011 for beach-nesting birds. Surveys will include all coastal habitat and

potential coastal habitat which supports solitary beach-nesting birds from the Florida/Alabama border to Galveston Island, Texas. All colonial beach-nesting birds will also be counted throughout these sites during surveys for solitary nesting species. To avoid disturbance, sites known to support only colonial nesting birds will be surveyed from the perimeter/shoreline to check for solitary nesting species. Surveys will be conducted at each site/area once to document the estimated number of beach-nesting bird pairs active during the 2011 breeding season. Individual pair counts will be conducted for all solitary nesting species. Solitary beach-nesting birds will be classified as breeding pairs under the following descriptions: 1) Pair exhibiting courtship behavior, 2) Pair engaging in joint defense, group defense, or other territorial behavior, 3) Single bird or pair at a nest, 4) Single bird or pair with young, 5) Paired adults (birds located together as a pair), and 6) Single bird exhibiting territorial/defensive/distraction behavior in breeding/nesting habitat. Flush counts and counts of sitting birds will be conducted for colonial nesting species. The survey focal species will include the following solitary beach-nesting bird species Wilson's Plover (*Charadrius wilsonia*), Snowy Plover (*Charadrius alexandrinus*), and American Oystercatcher (*Haematopus palliatus*). Migratory Piping Plovers (*Charadrius melodus*) will also be included in the census since its relatively low population counts give the species a status of global concern. Colonial nesting species include Black Skimmer (*Rynchops niger*), Least Tern (*Sterna antillarum*), Gull-billed Tern (*Gelochelidon nilotica*), Sandwich Tern (*Sterna sandvicensis*), and Royal Tern (*Sterna maxima*). Surveys will be conducted primarily on foot by teams of two or more highly skilled CBC field staff. Sites will be accessed using utility vehicle (UTV), 4x4 pick-up truck, airboat and boat, depending on the type of terrain present and size of each survey area. For solitary nesting species (Snowy Plover, Wilson's Plover, American Oystercatcher) each breeding pair will be GPS recorded using a hand held GPS unit. For colonial species a center point for each colony will be recorded. For all solitary breeding pairs and colonies located, data will be collected on macro and microhabitats used by each species including data on vegetation and substrate type. All survey sites will be assessed for human-created disturbance and habitat degradation. Habitat damage will be photographed and documented. All 2011 survey sites will be photographed for comparison to 2010 habitat photographs. Band combinations will also be recorded for banded focal species located.

Relationship to Other Activities and Data

Seabirds, colonial water birds, coastal marsh birds, raptors, shorebirds, and waterfowl are particularly susceptible to impacts from the oil at sea and on land. Several work plans have been developed to concurrently evaluate oil spill related injuries to these different avian guilds. This plan is a supplement to the eighth in a series of avian injury studies conducted by the Trustees and specifically seeks to address injury to breeding beach-nesting birds.

Since the early 2000's the CBC program has documented and monitored significant shorebird populations throughout the Gulf coast and has lead statewide and region-wide breeding and nonbreeding shorebird monitoring efforts in all Gulf coast states. The CBC has also collected data and gained a clear understanding of human-created shorebird disturbance (pre-spill causes and impacts) that will serve as important comparison data to the current oil-related impacts occurring in shorebird habitat that formerly had little or no disturbance. In addition, the CBC conducted population surveys of beach-nesting birds on the Gulf coast in oil impacted areas of Alabama, Mississippi and Louisiana during the 2010 breeding season as part of the natural resource damage assessment.

Coordination and Implementation

This study is currently ongoing and will continue through late June 2011, lasting approximately eight weeks. While the Trustees have provided a copy of a scope of work for this activity to BP, BP has not yet agreed to fund and participate in this activity.

Budget

The Claim amount for this study is \$260,000 plus associated DOI personnel costs to implement and oversee the study.

5.9 UV Screening to Detect Petroleum on Bird Plumage with Ultraviolet Light

Purpose and Injury Assessment Need

This study will evaluate a field screening method to detect petroleum on bird plumage with UV light used by field personnel as part of Deepwater Horizon pre-assessment and assessment studies. The results of this study will help determine the accuracy and precision of the UV screening methods to better assess the extent of external oiling of captured birds and recovered carcasses.

Several pre-assessment and assessment studies investigate potential bird exposure to spill-related crude oil through the capture and investigation of live birds. PAH compounds in crude oil fluoresce when illuminated with UV light (for example, see John and Soutar 1976, Payne et al. 1984, Ryder 2004). Deepwater Horizon NRDA studies take advantage of this characteristic in an attempt to better estimate potential bird exposure to oil, recording fluorescence of foreign substances on live birds under UV illumination. Results include observations of fluorescence on both visibly and not visibly oiled live birds, as well as carcass materials recovered during survival studies. Further study of factors that may affect fluorescence and its use as an indicator of DWH crude oil contamination is needed to refine estimates of the number of birds exposed to oil during the Incident.

Methods

Study Area

Live birds, bird carcasses and feathers from multiple species of birds collected throughout the area potentially impacted by the Deepwater Horizon Oil Spill.

Sampling Design

The initial focus of the evaluation is to use laboratory confirmation testing to determine whether foreign substances on birds observed to fluoresce are crude oil. This method will use archived bird feather samples collected from the field. If the amount of fluorescing substance on archived feathers is below that required for positive identification as oil, study methods will be adapted to evaluate the likelihood that fluorescing substances on birds observed in the field was oil (e.g., through laboratory analysis of feather samples exposed as part of this study to archived MC252 oil and other substances).

As part of pre-assessment and assessment studies, field crews determined the presence or absence of “fluorescing crude oil” based on the identification of orange fluorescence radiating from bird feathers when exposed to UV light. For this study investigators will obtain a selection of archived bird feathers from five species that: 1) represent bird species of importance to the injury assessment; and 2) were labeled as positive or negative for oil based on field UV analysis. These feathers will be re-tested to determine if fluorescence is still present based on the UV technique. Seven feathers from each of five bird species identified as positive for fluorescence by field UV analysis will be submitted to a qualified lab. Feathers will be analyzed for the presence of MC252 oil (TPH (EPA 8015 GC/FID), PAHs (EPA 8270M GC/MS), and geochemical biomarkers (EPA 8270M GC/MS)) using MC252 NOAA NRDA protocols.

The contract lab will summarize the findings of this evaluation in a report. It will calculate the rates of accurate determinations, false positives, and false negatives. In addition, it will discuss method sensitivity relative to the degree of oiling, oil weathering, and species of bird.

Relationship to Other Activities and Data

As noted above, this study is relevant to and will aid in the interpretation of data from several pre-assessment and assessment studies.

Coordination and Implementation

This study will begin shortly after funding is committed, and is expected to be conducted over a period of approximately three months.

Budget

The Claim amount for this study is \$63,000 plus associated DOI personnel costs to implement and oversee the study.

5.10 Wildlife Operations and Law Enforcement Data Assessment for Beached Bird Model Use

Purpose and Injury Assessment Need

Carcass recoveries by beached bird survey crews represent only a portion of the total recoveries for this Incident. Many carcasses were recovered by Wildlife Ops (Ops) and LE personnel. Considerable Ops (and to a lesser extent LE) search effort occurred in marshes and other access-limited areas, and extensive records from these trips are available for NRDA use. These records include daily narrative reports, GPS track lines, and recovery coordinates. This supplemental study will evaluate the extensive Ops/LE data and trip records to associate Ops/LE-collected carcasses with Ops/LE search area and effort and estimate the searcher efficiency of Ops/LE field personnel. This information will assist injury quantification efforts by developing estimates of carcass deposition rates in areas where the systematic and frequently repeated beached bird surveys were not conducted.

Methods

Study Area

Review of wildlife operations carcass data will focus on areas/habitats where significant bird carcass recoveries occurred in 2010 but beached bird surveys were not conducted. These areas primarily consisted of non-walkable habitats or beaches with restricted NRDA team access. These habitats include areas with robust emergent vegetation, edges of bays, estuaries, marshes accessible by motorized boat and other areas where regular NRDA team access was not possible. The data analysis will be conducted on data collected from throughout the spill area, approximately Atchafalaya Delta, LA to Pensacola Bay, FL. Preliminary data suggests that a focus on southeastern Louisiana marshes will be a priority.

Sampling Design

Task 1: Compilation and Analysis of Wildlife Ops and Law Enforcement Data

The PI will, with DOI staff assistance, retrieve, compile, and evaluate extensive Ops (and LE) data and trip records to associate Ops/LE-collected carcasses with Ops/LE search effort in order to use these for estimating carcass deposition rates. In particular, a review of search team track lines and documentation will be conducted to identify those “transects” which were not in response to distressed bird reports. These searches will be a higher priority of this data compilation effort. Data review will include both boat- and helicopter-based operations.

Task 2: Estimate Searcher Efficiency of Wildlife Ops and/or Law Enforcement Field Personnel

In order to utilize these data to estimate carcass deposition rates, the results of Task 1 must be integrated with searcher efficiency data for Ops/LE personnel. This Task will estimate searcher efficiencies by interviewing Ops/LE personnel who conducted the original surveys and by field studies to determine the detection function for these observers. Field studies of Ops/LE searcher efficiency will require bringing back to the spill area representative personnel that performed carcass collections on a Wildlife Ops or LE team. Searcher efficiency from both helicopters and boats relevant to Ops/LE efforts will be evaluated.

Relationship to Other Activities and Data

Information and analysis produced by this study will inform development of estimates of carcass deposition rates in areas where the NRDA beached bird surveys were not conducted (and so does not overlap with beached bird survey and related searcher efficiency and carcass persistence data). This study is an important complement to the marsh edge carcass persistence (see Section 5.3 of this document) and marsh edge searcher efficiency (see 5.2) Assessment studies.

Coordination and Implementation

The Principal Investigator will coordinate and implement an effort to evaluate the extensive Wildlife Ops and LE data and trip records to associate Ops/LE-collected carcasses with Ops/LE search effort.

The field studies proposed here focus on the search efficiency of Ops and LE personnel primarily during the late spring and summer, from the observation platforms they use (e.g., helicopter, specific type of boat, etc.), and using the search styles routinely employed by Ops/LE personnel.

While the Trustees have provided a copy of a description of this activity to, BP has not agreed to the activity. This activity does not require a work plan, so none was presented BP.

Budget

The Claim amount for this study is \$164,000 plus associated DOI personnel costs to implement and oversee the study.

5.11 Avian Injury Quantification Technical Support

Purpose and Injury Assessment Need

Data needed to assess injury to birds from the Deepwater Horizon Oil Spill are being generated by a series of pre-assessment and assessment studies, many cooperative between the Trustees and BP. The following two models will be used, along with other lines of evidence, to assist in the evaluation and quantification of avian injuries:

1. The BBM, based on carcass deposition on beaches and marsh shorelines, carcass detection efficiency, carcass persistence and potentially other factors; and
2. The LOBM, based on the number of birds present in spill-affected areas, the percentage of birds oiled, oiled bird survival rates, and potentially other factors.

These models have been utilized to help quantify avian injuries in other oil spills (see, for example, Ford 2006 and Ford 2001). This assessment procedure will use Oil Spill-specific information in the BBM and LOBM, including review, analysis and incorporation of data from multiple studies. Potentially relevant data includes, but is not necessarily limited to:

- bird carcass counts in impact and reference shoreline areas;
- measures of search/observation team frequency and effort;
- detection rates for carcass search teams and live bird observers;
- carcass persistence on shoreline habitats;
- carcass drift trajectories;
- aerial survey data and density estimates;
- oiling rate observations for marsh birds, colonial waterbirds, pelagic birds, shorebirds, piping plover, waterfowl, and wintering open water waterbirds; and

- impact and reference area capture and marking studies to estimate survival rates for several avian species, including clapper rails, seaside sparrows, brown pelicans, black skimmers, great egrets, piping plovers, and American oystercatchers.

Methods

This activity will involve review and analysis of data generated by pre-assessment studies, Assessment studies and potentially other data sources, development of model inputs, implementation of the model, and report development.

Relationship to Other Activities and Data

As noted above, this activity will integrate data from several pre-assessment and assessment studies.

Coordination and Implementation

The activity is expected to be conducted over the next 12-18 months, although the timing is contingent upon completion of other avian-related assessment activities.

Budget

The Claim amount for this study is \$775,000 plus associated DOI personnel costs to implement and oversee the study.

5.12 Blood Physiology Study

Purpose and Injury Assessment Need

The objective of this study is to determine whether hemolytic anemia is a key diagnostic feature in birds oiled by the Deepwater Horizon Oil Spill and whether biomarkers of hemolytic anemia and other physiological and biochemical indicators of bird health are consistently related to oiling of birds. The negative effects of PAHs found in crude oil on marine, aquatic, and terrestrial ecosystems have been described, and are associated with an array of physiologic consequences including inflammation, immunosuppression, and oxidative damage to cells (Leighton, 1995; Briggs et al., 1996; Prichard et al., 1997; Golet et al., 2002; Iverson and Esler, 2010). Of these physiologic impacts, oxidative damage to red blood cells and subsequent anemia is of particular importance in birds exposed to oil.

Hemolytic anemia has been demonstrated in several species of birds exposed to crude oil (Leighton et al., 1983; Fry and Lowenstine, 1985; Leighton, 1986; Couillard and Leighton, 1993; Yamato et al., 1996). Anemia causes reduced availability of oxygen to tissues, which leads to anaerobic metabolism, altered cell membrane permeability, cellular and tissue dysfunction, and if it progresses, ultimately organ failure. In a controlled dosing study in Atlantic Puffins (*Fratercula arctica*) and Herring Gulls (*Larus argentatus*), Leighton et al. (1983) demonstrated a dramatic reduction in the number of circulating red blood cells in birds orally dosed with large

volumes of crude oil. The presence of damaged hemoglobin in these red blood cells, as evidenced by Heinz body inclusions (also called Heinz-Ehrlich bodies), points to oxidative damage as a mechanism of anemia. In heavily oiled birds admitted to rehabilitation facilities, Troisi et al. (2007) went further to demonstrate a correlation between circulating PAH concentrations in the plasma of heavily-oiled Common Guillemots (*Uria aalge*) and Heinz bodies, as well as the plasma proteins, haptoglobin and ferritin, all of which indicate red blood cell destruction and oxidative damage. While the pathophysiology following exposure to crude oil may be multifactorial, oxidative hemolytic anemia likely plays a key mechanistic role in morbidity and mortality.

Methods

The blood for this study came from birds sampled as part of three pre-assessment studies from the Deepwater Horizon NRDA: 1) the Secretive Marsh Bird; 2) the Non-breeding Shorebird; and, 3) the Colonial Waterbird pre-assessment studies. Samples collected from Black Skimmers (BLSK), Brown Pelicans (BRPE), Great Egrets (GREG), Clapper Rails (CLRA), and American Oystercatchers (AMOY) will be used in this ongoing study.

A suite of well-established indicators of hemolytic anemia has been used to determine whether birds manifest physiological impairment related to exposure to PAHs. These include packed cell volume, which is the proportion of blood volume that is occupied by cells, hemoglobin, which is the oxygen-carrying protein of vertebrate red blood cells, and mean corpuscular hemoglobin concentration, a value calculated from packed cell volume and hemoglobin that helps to further define anemic conditions. Additionally, the continuation of this study will measure the number of reticulocytes, which are immature erythrocytes (also called red blood cells or RBCs) that increase in circulation in response to anemia, and Heinz bodies, which are inclusions in erythrocytes resulting from oxidative injury to and precipitation of hemoglobin (Leighton et al., 1983; Troisi and Borjesson 2005, Troisi et al., 2006, 2007, Campbell and Ellis, 2007). Finally, this study will continue to analyze plasma samples to quantify ferritin, which is an iron-storage protein that is elevated in cases of hemolytic anemia and serves to trap free iron, and haptoglobin, an acute phase protein with antioxidant properties that functions to sequester hemoglobin leaked from lysed erythrocytes (Chamanza et al., 1999). Together, haptoglobin and ferritin can serve as additional clinical indicators of oxidative damage induced by PAH exposure.

In summary, this study will:

- Complete evaluation of physiological biomarkers of hemolytic anemia by conducting analysis for PAH concentrations, ferritin and haptoglobin in oiled birds captured in the areas impacted by the Deepwater Horizon Oil Spill or from reference areas (N = up to 245 total)
- Relate physiological biomarkers of hemolytic anemia and other physiological/biochemical indicators of bird health to circulating levels of PAHs and the degree of external oiling observed on birds
- Complete data analysis and interpretation, and generate a final report on all birds sampled over the multi-year study period.

Relationship to Other Activities and Data

In three pre-assessment studies, the Colonial Waterbird Study, Secretive Marshbird and Non-breeding Shorebird studies, biological samples were collected to evaluate changes in blood constituents in birds exposed to DWH oil. This Claim seeks funds to continue ongoing assessment of physiological injury to oiled birds by evaluating blood parameters from samples already collected from birds in the Gulf and reference locations. Currently, all samples have been collected from the field; analysis of Heinz bodies, serum chemistry, hemoglobin and CBC are complete. On-going laboratory analyses of PAH concentrations, ferritin and haptoglobin continue. Funding data analysis is also part of this Claim.

Coordination and Implementation

Activities funded through this effort will begin immediately and are expected to continue through May 2012. While the Trustees have provided a description of this activity, BP has not agreed to fund and participate in the activity. A work plan is not needed for this activity.

Budget

The Claim amount for this activity is \$125,000 plus associated DOI personnel costs to implement and oversee the study.

5.13 Avian Toxicity Studies

Purpose and Injury Assessment Need

The Trustees will conduct avian toxicity studies to evaluate the effects of DWH oil, dispersants and their related compounds on various representative avian species. Spill-specific toxicity studies will assist with interpretation of field and laboratory avian studies conducted in the pre-assessment phase of the NRDA throughout oil-impacted areas in the Northern Gulf region, particularly with respect to evaluation of the impacts of oil exposure that does not result in immediate or short-term mortality but may cause physiological impacts that may ultimately impact avian survival, reproduction and health. Information gained will be used to evaluate the impacts of low to moderate oil exposure and potentially repeated oil exposure on avian health and associated long-term survival and productivity.

Existing technical literature indicates that exposure of birds to even small quantities of oil may cause a number of physiological changes that may adversely impact the exposed individuals. For example, birds such as Cassin's auklets and common murrelets exposed to crude oil as a result of either field exposure during an oil spill or experimental exposure have exhibited physiological changes including hepatocellular dissociation and hemosiderosis, renal tubular necrosis, and hemolytic anemia (Fry and Lowenstine 1985). Butler et al. (1988) found that internal or external exposure of Leach's storm petrels to crude oil or oil-Corexit emulsion significantly reduced hatching and fledging success in a dose dependent manner, likely due to behavioral changes. As little as 0.10 ml of applied oil (internal or external) was associated with significant effects (e.g. 20% of eggs hatched vs. 60% of control eggs hatched). A number of studies have demonstrated that birds exposed to oil exhibit altered behavior, including more time preening and bathing and

less time feeding and resting (Burger 1997; Burger and Tsipoura 1998; Larsen and Richardson 1990; Chapman 1981). Avian toxicity data for species, oil, dispersants and related compounds specific to this Incident have been identified to inform injury determination and quantification analyses for this incident.

Methods

This study has two phases. Phase I entails development of a work plan outlining the types of studies to be conducted, based on the expertise and advice of a team of NRDA and avian toxicology experts. Facilities capable of conducting avian toxicology studies will be visited and locations chosen based upon their capabilities and the requirements of the work plan. Phase II will be study implementation. Experts and locations for Phase II work will be dependent upon the objectives identified in the work plan, personnel and facility capabilities, and cost. Additional detail on Phase I and Phase II tasks is provided below.

Phase I

Specific Phase I objectives include:

- Ia) Identify specific avian toxicity evaluation objectives and approaches based on pre-assessment information, initial injury and exposure information, identified data gaps and the scientific literature;
- Ib) Identify subject-matter specialists including, but not limited to: avian toxicologists, pathologists and ecologists, community ecologists, statisticians, and Gulf of Mexico ecosystem/ornithological experts;
- Ic) Organize and facilitate communication and coordination with subject-matter specialists;
- Id) Compile a literature review on the effects of oil on avian resources. Synthesize, summarize, and disseminate the review as necessary;
- Ie) Develop investigative approach to address NRDA objectives related to avian toxicity;
- If) Write specific work plans to address objectives identified during the planning stage; and
- Ig) Identify and select organizations and facilities that can accommodate avian toxicity research.

Blood indicators of physiological impairment have been investigated in a number of birds as part of the Secretive March Bird, Non-breeding Shorebird and Colonial Waterbird pre-assessment studies. These data are being provided to BP as part of the on-going studies. The Trustees will use these preliminary results, as well as information from the literature and consultation with specialists, to identify objectives and design toxicity studies to be performed during Phase II.

Phase II

Upon completion of an avian toxicity work plan, Phase II objectives will include:

IIa) Implement avian toxicity studies; and

IIb) Analyze resulting data and provide comprehensive reports of findings.

Relationship to Other Activities and Data

Several pre-assessment studies are generating information regarding the exposure of avian receptors to DWH oil, dispersants and related compounds (see <http://www.doi.gov/deepwaterhorizon/adminrecord/Pre-assessment-Birds.cfm>). This study will be used to evaluate the impacts of low to moderate oil exposure and potentially repeated oil exposure on avian health and associated long-term survival and productivity.

Coordination and Implementation

This study was initiated within the DOI Avian Technical Team. The co-Trustees concur that avian toxicity testing is appropriate based upon: 1) data and preliminary results generated during the pre-assessment phase; and 2) the possible chronic effects of oil in environments inhabited by avian resources. Efforts on this study will begin immediately, and are expected to continue through 2012.

While the Trustees have provided a description of this activity to BP, BP has not agreed to fund and participate in the activity. No work plan is needed for the initial work of this activity, which is development of a work plan(s).

Budget

The Claim amount for this activity is \$4,785,000 plus associated DOI personnel costs to implement and oversee the study.

Phase II

Toxicity Studies: Based on market research and comparison with other similar studies, the Trustees estimate that toxicity study costs will be approximately \$4.5 million dollars. Costs associated with this phase include salaries of principal investigators, travel, establishment and maintenance of captive avian test flocks, dosing studies, data collection/analysis, and report writing. A detailed budget will be provided pending the outcome of Phase I.

6.0 Endangered/Threatened Fish

6.1 Gulf Sturgeon

Purpose and Injury Assessment Need

This study will assess potential injuries to Gulf sturgeon (*Acipenser oyrinchus desotoi*) resulting from the Deepwater Horizon Oil Spill. The study evaluates fish movement and habitat utilization using ultrasonic telemetry, overall health of the sturgeon and potential impacts to sturgeon from exposure to oil. The exposure assessment of the Gulf sturgeon will be based on chemical analysis of PAHs and associated petroleum hydrocarbons in the field-collected blood samples, while the injury assessment will be based, in part, on cytogenetic and genomic responses observed in the same blood samples to evaluate toxicity to immune and hematological function. The field work will be conducted in two phases, concurrent with the Gulf sturgeon migration: 1) in late summer and fall of 2011 and 2) in spring 2012. This plan is similar to the 2010 Gulf sturgeon pre-assessment plan

Methods

This study consists of two main objectives: 1) determination of exposure and 2) assessment of injury in the Gulf sturgeon. Injury will be evaluated through analysis of blood collected during the field investigations. The exposure assessment of the Gulf sturgeon will be based on chemical analysis of PAHs and associated petroleum hydrocarbons in the field collected blood samples, while the injury assessment will be based on cytogenetic and genomic responses observed in the same blood samples. This study requires two field collection efforts, laboratory analysis of blood samples collected from these fish, and a controlled laboratory exposure study with sturgeon to calibrate the biological measurements of injury. The first fish collection will occur during the summer and fall of 2011 prior to fish migration into the Gulf of Mexico. The second fish collection will occur in the spring of 2012 as the fish return from the Gulf of Mexico to spawn in freshwater rivers.

Study Area

Gulf sturgeon will be collected from eight of the rivers sampled during the pre-assessment study. The Ochlockonee River has been removed from the survey since no fish were collected in that system during the pre-assessment study.

Relationship to Other Activities and Data

This study will continue to document offshore movement and habitat use of 134 adult Gulf sturgeon tagged as part of the 2010 pre-assessment monitoring effort as well as tag and monitor an additional 160 Gulf sturgeon in 2011. Previous studies have collected important natural history data for the threatened Gulf sturgeon, providing important baseline estuarine and nearshore marine habitat use data prior to the Deepwater Horizon Oil Spill. The proposed work relies on known effects of PAH and oil responses in the blood of exposed organisms. Other natural resource damage assessment plans that may complement this study include those looking at contamination of the prey base and submerged oil in coastal areas.

Coordination and Implementation

Six field teams will be required to collect fish in eight separate rivers during fall 2011 and spring 2012 in addition to laboratory coordination.

Budget

The Claim amount for this study is \$1,074,768 plus associated DOI personnel costs to implement and oversee the study.

7.0 ENDANGERED/THREATENED MAMMALS

7.1 Beach Mice Assessment

Purpose and Injury Assessment Need

This study will document Deepwater Horizon response related disturbance to or destruction of the endangered and candidate beach mice species (*Peromyscus polionotus sp.*) sand dune habitat in Alabama and Florida by mapping the current condition of dune habitat in areas where response activities occurred in known or potential beach mouse habitat. Presently, it does not appear that product from the Deepwater Horizon Oil Spill will impact beach mice on a biological level. However, to carry out activities necessary to keep said product away from beaches, out of beach mouse habitat, and clean it off the beaches (e.g., access points for boom deployment and clean-up crews, actual clean-up activities etc.), impacts to beach mice and their habitat may have occurred.

Both occupied and potential habitat areas will be surveyed because both are considered critical to the maintenance of this subspecies, and beach mouse population numbers and occupied habitat can vary over time. Disturbance and or destruction of beach mouse habitat could impede recovery of this species, and documentation of potential disturbance will be used to evaluate the impacts of spill related response activities.

Methods

This study has two phases. Phase I entails development of a map of dune habitat that exists within the range of each Gulf Coast beach mouse subspecies and Phase II involves an assessment of injury to beach mouse habitat

Study Area

Ground surveys and aerial imagery will be studied within beach mouse habitat of the five subspecies that occur in Alabama and the Florida panhandle (i.e., Alabama beach mouse, Perdido Key beach mouse, Santa Rosa beach mouse, Choctawhatchee beach mouse, and St. Andrews beach mouse).

Phase I:

Beach Mouse Habitat Identification:

Beach mouse habitat is well understood and documented (Loggins et al. 2008). Any dunes within a subspecies' range are potential habitat. Beach mouse habitat maps will be created by interpreting dune features from the most recent pre-spill aerial maps. USFWS published maps displaying the location of designated beach mice critical habitat will be used as a starting point. However, these maps do not depict all beach mice habitat, as certain areas were excluded from critical habitat for reasons unrelated to the biological needs of the species. As a result, maps of critical habitat provide a starting point for identifying beach mice habitat, but they cannot be relied on exclusively for identification of all existing or potential beach mouse habitat, and will be supplemented by ground truthing.

Phase II:

Beach Mouse Habitat Injury Assessment:

To assess potential injury to beach mice, the Trustees will evaluate injury to beach mice habitat associated with Deepwater Horizon response activities. The focus of this plan is to quantify conditions where disturbance or destruction is observed in high-resolution aerial photography. Information on potential impacts to beach mice habitat associated with Deepwater Horizon response efforts will be solicited from public land managers, agency officials, or beach cleaning crews familiar with the habitat within the area defined in Phase I. Dunes will be considered injured when the sand has been moved, altered, or compacted, and when vegetation has been disturbed or killed as a result of response activities. The acreage of habitat injured will be measured by a minimum two-person crew with GPS units walking the perimeter of impacts associated with clean up activity. As a quality control measure, both individuals will walk and record the extent of the injury. Pictures will also be taken at GPS points to characterize the nature of the injury. The pre-impact floral community will be estimated by using an undisturbed, adjacent reference, of equal size and proportion, with aerial imagery, as a proxy for what had been there previously. The total number of plant species and the percent species composition will be recorded. The percent coverage density of each species will be determined in adjacent plots to the nearest 10% via visual estimation and assigned a qualitative category from minimal to severe.

Relationship to Other Activities and Data

This study will utilize existing USFWS published maps, as well as information from response crews and public land managers, agency officials, and beach cleaning crews familiar with the study area.

Coordination and Implementation

The work will be conducted by a lead coordinator who will serve as the point of contact and lead on field activities. Development of detailed field protocols and implementation of this study will be a cooperative effort among the Trustees and BP. DOI and BP signed this plan and have been coordinating its implementation. Activities funded through this effort will begin in June and are expected to continue for approximately four weeks.

Budget

The Claim amount for this study is \$66,360 plus associated DOI personnel costs to implement and oversee the study.

8.0 OTHER ASSESSMENT PROCEDURES

8.1 Aerial Imagery

Purpose and Injury Assessment Need

This assessment activity addresses imagery needs, provides related technical support, and identifies remote sensing products to be utilized case-wide to support the other TWGs involved in the Deepwater Horizon NRDA. This plan has two components: 1) identifies a set of primary tools deemed necessary by the Aerial Imagery TWG (AITWG) (made up of representatives from both federal and state trustees, in cooperation with BP) to provide the aerial imagery missions as requested by the other TWGs and their activities; and 2) the methodologies for interpretation of the imagery and analysis of the derived data.

Certain TWGs (i.e., Shoreline, Submerged Aquatic Vegetation, Turtle) requested imagery to support the individual injury determination and quantification for specific resources that may have been impacted by the Deepwater Horizon Oil Spill. Procurement of aerial imagery with clearly defined technical specifications which meet the needs of the resource TWGs is a key output of this plan. Working cooperatively with BP, the AITWG has already obtained imagery from fall 2010 and spring 2011, but additional post-spill imagery (fall 2011 and spring 2012) is planned. A separate work plan also identifies methodologies for data interpretation and mapping for marsh, shoreline, and seagrass habitats.

Resulting data and maps will inform the determination and quantification of injured habitats attributable to Deepwater Horizon Oil Spill and associated response activities.

Methods

Key objectives of this plan include:

- Identification of appropriate pre-spill imagery and coverage;
- Identification of post-spill impact imagery and coverage;
- Satellite imagery identification and acquisition;
- Low flight rapid assessment;
- High resolution aerial imagery acquisition;
- Acquisition, classification, and analysis of AVIRIS data;
- Interpretation and development of data of baseline imagery for seagrass, marsh, scrub-shrub, flats, beaches, and shoreline;
- Interpretation and development of data of sequential fall coverage for seagrass, marsh, scrub-shrub, flats, beaches, and shoreline;
- GIS analysis of change between baseline and subsequent fall and spring coverages; and,
- Prop scarring interpretation within seagrass habitats, berm monitoring, sargassum identification, and boom and airboat interpreted impacts in marsh habitats.

Relationship to Other Studies and Data

This plan is related to other assessment studies in that it will provide useful imagery and technical support for other TWGs including the Shoreline, Submerged Aquatic Vegetation, and Turtle TWGs.

Coordination and Implementation

The AITWG is led by a representative from USGS. Due to multiple dates of imagery acquisition through the spring of 2012, the AITWG estimates that the total work effort would be expended over approximately 18 months starting June 2011. BP signed the work plan, “*Technical Specifications and Scope of Work/Services for Aerial Image Acquisition and Image Processing in Support of the MC252 NRDA Process*” and the fall 2010 and spring 2011 overflights were conducted in accordance with that plan. Costs affiliated with the fall 2010 and spring 2011 overflights are not included in this Claim; however costs affiliated with the fall 2011 and spring 2012 imagery acquisition are included.

Budget

The Claim amount for this study is \$5,040,000 plus associated DOI personnel costs to implement and oversee the study.

8.2 Response Injury and Sandy Beach Technical Assistance

Purpose and Injury Assessment Need

The objective of this assessment activity is to compile the various sources of information that may be used to assess injury related to response actions *on the shoreline*. Response injury is an injury type separate from oil exposure and, in some cases, may significantly affect the recovery rates of different habitats and resources, even those that were not directly oiled. However, the information on the temporal and spatial extent of response-related injuries is scattered among many organizations, usually not collected consistently, and has been difficult to obtain. Furthermore, different TWGs have still yet to determine the types and level of detail of response injury that they will need in their injury quantification and how this information will be used.

Although the USFWS, USACOE, and the U.S. Coast Guard (USCG) have been working to identify response injury-related information, it has proven difficult to obtain information from the various sources. There is a timing element as the response stands down by the end of the 2011. Therefore, this activity is for technical assistance to compile response related information from the various sources, including from USFWS, USACE, and the USCG, and coordinating with BP pertinent to shoreline.

Methods

This plan consists of two main activities: (1) identifying the types of ecological impacts of concern to the Sandy Beach TWG and mapping out how it will use response data in quantifying the extent and duration of injury for the resource. This will be done initially for the Sandy Beach

sub-group under the Shoreline TWG; and (2) Acquire and organize the detailed information on response actions needed by the Sandy Beach sub-group, Bird and other TWGs. Results of this effort, in combination with efforts already underway or being contemplated in the NRDA, will provide necessary data on potential injury to specific resources of concern, such as piping plover, black skimmers and other bird species as well as loggerhead sea turtles.

Activity 1: Response Injury Need Assessment for the Sandy Beach sub-group

Support Sandy Beach sub-group will develop a description of types of response activities and resulting potential injury that may be used in injury quantification.

Activity 2: Response Injury Information Acquisition and Organization for the Sandy Beach sub-group

Acquire and organize the information responsive to the categories of potential injury and/or correlating response actions. This includes developing strategies for response injury information organization and structure to facilitate its use by the Sandy Beach sub-group, as well as the Shoreline, Bird and other TWGs. Different types of information will be useful to document and provide visual evidence of the types of injury, such as representative photographs of the different types of mechanical and manual treatment whereas other information will be used to identify the duration of different response actions by appropriate geographical areas, such as when manual treatment started and stopped on the beaches of the Gulf Island National Seashore or the volume of oiled materials removed from sand beaches. The Response Injury Knowledge Hub along with other data management systems currently in use by the Trustees will be evaluated as both an information management option and also as a vehicle to summarize and evaluate information for injury assessment.

Relationship to Other Activities and Data

The USFWS Response Injury Coordinators have been working to identify possible sources of response injury information and coordinate with various Trustee efforts on similar efforts. The USACE has developed a Response Injury Knowledge Hub (<https://oskh-01.usace.army.mil/>) to provide centralized data storage of response injury-related files (documents, photos, videos, etc.) for access by all Trustees and TWGs.

This work will involve close coordination with other government agencies involved in similar actions and needing similar types of information, such as the USCG and USFWS for Section 7 consultation under the Endangered Species Act.

Coordination and Implementation

These response action sand beach injury activities will require approximately 150 days (60 days for activity 1 and 90 days for activity 2) and will begin immediately.

Budget

The Claim amount for this activity is \$158,366 plus associated DOI personnel costs to implement and oversee the study.

8.3 Near Shore Benthic Prey Organisms

Purpose and Injury Assessment Need

This plan will assess the extent to which benthic prey organisms located in foraging habitats important to biological resources of concern are contaminated with MC252 oil. Study results, in combination with efforts already underway or being contemplated in the NRDA, will provide necessary data on potential pathways of exposure to specific resources of concern, such as Gulf sturgeon, piping plover, Kemp's ridley sea turtles and loggerhead sea turtles, and groups of species with similar feeding strategies including shorebirds, diving ducks, and dabbling ducks. Although the flow of oil leaking into the Gulf ended in summer 2010, resources of concern could still be exposed to oil, oil-dispersant mixtures and their byproducts via a contaminated food base.

Methods

This study will measure contaminants, specifically hydrocarbons and dispersants, in and on benthic organisms that are food items for biological resources of concern to determine whether a pathway of exposure exists between benthic prey items and biological resources of concern.

Relationship to Other Activities and Data

This plan coordinates with other assessment procedures on important prey species and submerged oil that are currently under development in the ongoing NRDA to encourage consideration of sampling in foraging areas and to ensure no redundancy in sampling effort. In addition, this plan accounts for previously implemented pre-assessment and assessment plans, as well as plans currently under development, which include collection and analysis of prey items.

Coordination and Implementation

The Trustees estimate that 8,500 hours of labor effort are required to implement this study, which would be expended over approximately 12 months, beginning in July 2011.

Budget

The Claim amount for this study is \$961,000 plus associated DOI personnel costs to implement and oversee the study.

8.4 JELA SAV Plan

Purpose and Injury Assessment Need

The objective of this study is to assess potential impacts on the JELA SAV community following the diversion of Mississippi River freshwater flows in response to the Deepwater Horizon Oil Spill. Freshwater flows were diverted from the Davis Pond Diversion to Lake Cataouatche, adjacent to JELA, to reduce the potential for oil intrusion into the inland marshes. Comparison of data obtained from impacted and reference sites will inform injury determination. If injuries are confirmed, study data will provide a basis for injury quantification.

Previous studies have shown that increased nutrients to lakes result in reductions in SAV due to increased density and abundance of phytoplankton and algal epiphytes (Kalff, 2002). In lakes, shifts from SAV-dominated communities to phytoplankton-dominated communities can occur with nutrient addition (Dodson, 2005). Similarly, in marine and estuarine communities SAV is replaced by macroalgae with nutrient addition (Day et al., 1989). Based on fundamental SAV ecology, high loading of nitrogen and phosphorus from the increased Mississippi River flow has the potential to adversely affect the SAV community in JELA. These effects may vary seasonally, since nutrients can affect seasonal recruitment and growth patterns of SAV, as well as phytoplankton, floating aquatics, and macroalgae. Therefore, response impact studies conducted in the spring and fall of 2011 are needed to assess large-scale changes in SAV community structure and water quality.

Methods

Field surveys will quantify physical and chemical water quality parameters, sediment and water nutrient levels nutrients (total nitrogen [TN] and total phosphorous [TP]), and will assess potential shifts in SAV community structure and/or floating aquatic species abundance. Surveys will include assessments of SAV species composition at 36 stations located within the northeast portion of the Barataria Estuary in JELA and at five reference stations located north of the Davis Pond Diversion.

Relationship to Other Activities and Data

An initial field survey was performed in September 2010 that assessed SAV community structure and water quality. The proposed additional field surveys for spring and fall 2011 will determine if seasonally distinct impacts to water quality and the SAV community within JELA are evident as compared to reference stations, the fall 2010 survey, and the prior Poirrier et al. (2009) survey in JELA.

Coordination and Implementation

BP signed the JELA SAV Field plan and participated in the May 2011 sampling effort which has already concluded. Field surveys are planned for the fall (September 2011) and will be completed within a nine-day period.

Budget

The Claim amount for this study is \$142,506 plus associated DOI personnel costs to implement and oversee the study.

8.5 Quality Assurance and Quality Control Program

This activity is a DOI-wide Quality Assurance and Quality Control (QA/QC) program to promote data quality, specifically in data accumulation, management, storage and integration into products resulting from DWH NRDA activities. This program will continue to work with

data management personnel within each assessment procedure to provide a common guidance for quality assurance practices employed across all DOI projects, specific project guidance and interpretation, and examples and critique of methods wherever specific assistance is required. DOI QA/QC will also work closely with other trustee quality and data management programs to promote consistency across the Deepwater Horizon NRDA.

The Claim amount for QA/QC is \$153,500.

8.6 Expert Consultation and Technical Support

Data needed to assess and quantify injury to natural resources of concern from the Deepwater Horizon Oil Spill are being generated by a series of pre-assessment and assessment procedures, many of which are cooperative between the Trustees and BP. As the NRDA proceeds, additional need for technical support and expert consultation may be identified by DOI and the Trustees for additional field work, laboratory and data analysis to support injury determination and quantification as well as the feasibility of possible restoration actions.

The Claim amount for expert consultation and support is \$1,504,948.

8.7 Early Restoration Planning

This activity includes technical support for participation in the early restoration process recently agreed to by the Trustees and BP. The Claim amount for this activity is \$450,000.

9.0 DOI COORDINATION, OVERSIGHT, IMPLEMENTATION AND ANALYSIS COSTS

Coordination, oversight, and planning costs are the administrative, legal, enforcement, monitoring, oversight, and public participation costs as set forth in the definition of “reasonable assessment costs” in the OPA Regulations at 15 CFR Part 990. These include, among other things, the cost of participation in TWG activities, Trustee Council and co-trustee coordination, communication and coordination with PRPs, and public outreach. These costs were estimated based on anticipated activities through 2012.

10.0 LITERATURE CITED

- Alam, S.A. and M.S. Brim. 2000. Organochlorine, PCB, PAH, and metal concentrations in eggs of loggerhead sea turtles (*Caretta caretta*) from Northwest Florida, USA. *Journal of Environmental Science and Health*, B 35(6):705-724.
- Buckland, S. T. , Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., and Thomas, I. (2001). *Introduction to Distance Sampling*, Oxford University Press, Oxford.
- Buckland, S. T. , Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., and Thomas, I. (2004). *Advanced Distance Sampling*, Oxford University Press, Oxford.
- Burger, J and N Tsipoura. 1997. Experimental Oiling of Sanderlings (*Calidris alba*): Behavior and Weight Changes. *Environ Toxicol Chem* 17(6): 1154 – 1158.
- Burger J. Effects of Oiling on Feeding Behavior of Sanderlings and Semipalmated Plovers in New Jersey. *The Condor* 99(2): 290 – 298.
- Butler, RG, A Harfenist, FA Leighton, and DB Peakall. 1988. Impact of Sublethal Oil and Emulsion Exposure on the Reproductive Success of Leach's Storm-Petrels: Short and Long-Term Effects. *J Applied Ecology* 25(1): 125 – 143.
- Byrd, G.V. and J.H. Reynolds. 2006a. Detection probabilities for bird carcasses on beaches of Unalaska Island, Alaska, following the wreck of the M/V Selendang Ayu. U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge, Homer, AK.
- Byrd, G.V., J.H. Reynolds, and P.L. Flint. 2009. Persistence rates and detection probabilities of bird carcasses on beaches of Unalaska Island, Alaska, following the wreck of the M/V Selendang Ayu. *Marine Ornithology*, 37: 197-204.
- Chapman BR. 1981. Effects of the Ixtoc I Oil Spill on Texas Shorebird Populations. 1981 Oil Spill Conference, American Petroleum Institute, Washington D.C. 742 pp.
- Day, J. W., C. A. Hall, W. M. Kempt. 1989. *Estuarine Ecology*. John Wiley & Sons, New York. 558 pp.
- Dodson, S. I. 2005. *Introduction to Limnology*. McGraw Hill, Boston. 400 pp.
- Ford, R.G., G.K. Himes Boor, and J.C. Ward. Final Report: Seabird Mortality Resulting from the M/V New Carissa Oil Spill Incident February and March 1999. Prepared for U.S. Fish and Wildlife Service and Oregon Fish and Wildlife Service. May 14, 2001.
- Ford, R.G., J.C. Ward, G.K. Himes Boor, and J.D. Storm. Final Report: Carcass Scavenging Rates Study for the M/V KURE/Humboldt Bay Oil Spill. Prepared for California Department of Fish and Game, Office of Spill Prevention and Response, April 2002.
- Ford, R.G. Final Report: Bird Carcass Scavenging Study. Prepared for Buzzards Bay Bird and Wildlife Assessment Team: Other Birds Sub-Team. Conducted by RG Ford Consulting, United States Fish and Wildlife Service, and ENTRIX. March 2005.
- Ford, R.G. 2006. Using beached bird monitoring data for seabird damage assessment: The importance of search interval. *Marine Ornithology*: 34: 91-98.

- Ford, R.G. and M.A. Zafonte. 2009. Scavenging of seabird carcasses at oil spill sites in California and Oregon. *Marine Ornithology* 37: 205–211.
- Fowler, A.C. and P.L. Flint. 1997. Persistence rates and detection probabilities of oiled King Eider carcasses on St Paul Island, Alaska. *Marine Pollution Bulletin*, 34: 522-526.
- Fry DM and LJ Lowenstine. 1985. Pathology of Common Murres and Cassin's Auklets Exposed to Oil. *Arch Environ Contam Toxicol* 14: 725 – 737.
- Hart KM, Zawada D.G., Fujisaki I., Lidz B.H. (2010) Inter-nesting habitat-use patterns of loggerhead sea turtles: Enhancing satellite tracking with benthic mapping. *Aquat Biol* 11:77-90, doi: 10.3354/ab00296.
- John, P. and I. Soutar. 1976. Identification of crude oils by synchronous excitation spectrofluorimetry. *Analytical Chemistry* 48:520-524.
- Kalff, J. 2002. *Limnology*. Prentice Hall, New Jersey. 692 pp.
- Larsen EM and SA Richardson. 1990. Effects of a Major Oil Spill on Wintering Shorebirds at Grays Harbor, Washington. *Northwestern Naturalist* 71(3): 88 – 92.
- Loggins, R. E., J. A. Gore, and L. A. Slaby. 2008. Long-term monitoring of beach mouse populations in Florida. Final Report to U.S. Fish and Wildlife Service, Panama City, Florida.
- Payne, J.R. and G.D. McNabb, Jr. 1984. Weathering of Petroleum in the Marine Environment. *Marine Technology Society Journal* 18(3): pp. 24-42, 1984.
- Poirrier, M.A., K. Burt-Utley, J.F. Utley, E.A. Spalding. 2009 An Inventory and Assessment of the Distribution of Submersed Aquatic Vegetation at Jean Lafitte National Historical Park and Preserve, New Orleans, April 2009.
- Rowe, C.L., C.L. Mitchelmore and J.E. Baker. 2009. Lack of biological effects of water accommodated fractions of chemically- and physically-dispersed oil on molecular, physiological and behavioral traits of juvenile snapping turtles following embryonic exposure. *Science of the Total Environment* 407:5344-5355.
- Ryder, A.G. 2004. Assessing the maturity of crude petroleum oils using total synchronous fluorescence scan spectra. *Journal of Fluorescence* 14:99-104
- Short, J.W., and K.R. Springman. 2007. Identification of hydrocarbons in biological samples for source determination. In: Wang, Z, and S.S. Stout, eds., *Oil Spill Environmental Forensics: Fingerprinting and Source Identification*. Academic Press, Burlington, MA. Pp 381-403.
- Summers, M.W. 1963. Managing Louisiana Fish Ponds. Louisiana Wild Life & Fisheries Commission. New Orleans 64 pp.
- Thomas, L, Buckland, S. T., Burnhan, K. P., Anderson, D. R., Laake J. L., Borchers, D. L., and Strindberg, S. (2002). Distance Sampling. Pp 544-552 in *Encyclopedia of Environmetrics*, A. H. El-Shaarawi and W. W. Piegorisch, eds. John Wiley and Sons, Ltd., Chichester.

- Trust, K.A., D. Esler, B.R. Woodin And J.J. Stegeman. 2000. Cytochrome P450 1A induction in sea ducks inhabiting nearshore areas of Prince William Sound, Alaska. *Marine Pollution Bulletin* 40(5):397-403.
- Van Pelt, T.I. and J.F. Piatt. 1995. Deposition and persistence of beachcast seabird carcasses. *Marine Pollution Bulletin*, 30:794-802.